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Agilent 7820A Gas Chromatograph

Maintaining Your GC

Agilent Technologies

Notices

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Waigaoqiao Free Trade Zone
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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Contents

1 About Maintaining the GC

This section provides an overview of the maintenance procedures included in this document. It also lists the tools needed for routine maintenance and the safety information one should be aware of before performing a maintenance task.

Overview of Maintenance

This manual details the routine tasks needed to maintain the 7820A Gas Chromatograph (GC). The procedures assume a basic knowledge of tool use and of GC operation. Readers are, for example, expected to know how to:

- Safely turn devices on and off
- Load methods
- Change component temperatures, flows, and pressures
- Make typical pneumatic connections using Swagelok and other standard fittings
- Reset GC service counters

Where to find a procedure

Included in this manual are chapters on maintaining the following GC components:

- Capillary Columns
- Split/Splitless Inlet
- Purged Packed Inlet
- FID
- TCD
- uECD
- NPD
- FPD
- PCM
- Valves

Each chapter includes:

- A list of the most commonly used consumables and parts for the component
- An exploded parts view of the component
- Detailed procedures for routine maintenance tasks associated with the component

Early Maintenance Feedback feature

Both the GC and Agilent Instrument Utilities software include the capability to alert users of upcoming maintenance needs. This feature, called Early Maintenance

Feedback, notifies users when a counter (such as a septum counter, liner counter, jet cleaning counter, injection counter, or uECD wipe test counter) has reached the specified maintenance point. After performing the required maintenance, reset the applicable counter to resume using the Early Maintenance Feedback feature. Refer to the Instrument Utilities help and the Advanced User Guide for more information.

Tools and Materials Required for Maintenance

Table 1 lists the tools needed for most GC maintenance procedures. The specific tools required to perform a maintenance procedure are listed in step 1 of the procedure.

Table 1 Tools and materials for GC maintenance

Common tools
Wrench, angled, septum nut (19251-00100)*
Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)*
Wrench, open-end, 9/16-inch and 7/16-inch (8710-0803)*
Wrench, capillary inlet (G3452-20512)*
Flathead screwdriver
Column cutter, wafer (5181-8836, 4/pk)*
Driver, nut, 1/4-inch (8710-1561)*
T-20 Torx key (8710-1807) or screwdriver*
T-10 Torx key (8710-2140) or screwdriver*
3-mm hex key wrench (8710-2411)
Electronic flow meter(s) or bubble meter(s) capable of calibrated measurements at 1, 10, and 100 mL/min flow ranges.
Electronic leak detector
Magnifying loupe, 20X (430-1020)
Metric ruler
Bench vise (for setting Swagelok fittings)
Razor or sharp knife
Tweezers (8710-0007) or thin needle-nose pliers (8710-0004)
Needle-nose pliers
ESD wrist strap (for installing new components)
Gloves, heat-resistant (for handling hot parts)
Wooden cotton swab (for removing FID filters)
Tools and materials for cleaning procedures
Cleaning brushes—The FID cleaning kit (9301-0985) contains appropriate brushes for cleaning detectors and inlets
Cleaning brushes—(8710-1346) For cleaning split/splitless inlet split vent fitting, FID and collectors

Table 1 Tools and materials for GC maintenance (continued)

Jet cleaning wire (.010 inch)
Clean, lint-free cloth (to protect contamination-sensitive detector parts)
Small ultrasonic cleaning bath with aqueous detergent (for cleaning detector and inlet parts)
Gloves, clean, lint-free, nylon (large: 8650-0030, small: 8650-0029) (for handling contamination-sensitive parts)
Steel wool, 0- or 00-grade (for cleaning an inlet's septum seating surfaces)

* Included with the GC ship kits

Maintenance Methods for the 7820A GC

Before most maintenance procedures, the GC must be made ready. Agilent recommends that you create and store the following maintenance methods into the GC. The methods below will:

- Prevent damage to the instrument (electronics, columns, etc.)
- Avoid injury to the user (burns, shocks, etc.)
- Allow you to perform maintenance on specific areas while leaving the rest of the GC components at operating temperature

NOTE Inlets and detectors at operating temperature may require 12 hours or longer to reach the maintenance method setpoints below.

You can use the software keyboard or your Agilent data system to create, save, and load these methods.

General GC Maintenance Method

Create this method for instrument column maintenance, detector maintenance, and general GC maintenance tasks.

- Set the oven temperature to **35 °C**. This allows the oven fan to assist cooling.
- Set all inlet temperatures to **35 °C** and set inlet gas pressures to **0.0**.
  - If performing column maintenance, remember to wait for the oven and column to cool down before turning off column carrier gas flow at the source. Also remember to cap both ends of the column to keep air out once it is removed.
  - If you are not performing column maintenance, keep inert carrier gas (helium or nitrogen) flowing to protect the column.
- Set all detector temperatures to **35 °C**.
  - If performing FPD maintenance, turn off the GC and unplug the power cord.
  - Some detectors (FID, NPD) use high voltages. For these detectors, turn the electrometer **Off** to disable the high voltage.

  - The filament in the TCD will be damaged if exposed to air while hot. To protect the filament, turn it **Off**.
- Set all detector flows to **Off**.

Once the zones reach < 70 °C, you can perform general GC maintenance.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

Inlet Maintenance Method

This method prepares the inlet for maintenance while leaving the detector at operating temperature.

- Set the oven temperature to **35 °C**. This allows the oven fan to assist cooling.
- Set all inlet temperatures to **Off** and set inlet gas pressures to **0.0**.
  - If performing column maintenance, remember to wait for the oven and column to cool down before turning off column carrier gas flow at the source. Also remember to cap both ends of the column to keep air out once it is removed.
  - If you are not performing column maintenance, keep inert carrier gas (helium or nitrogen) flowing to protect the column.
- Maintain all temperature setpoints for installed detectors, if desired.
  - The filament in the TCD will be damaged if exposed to air while hot. To protect the filament, turn it **Off**.

Once the zones reach < 70 °C, you can perform general GC maintenance.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

Safety Information

Before performing a maintenance task, read the important safety and regulatory information found in the Safety and Regulatory Information book.

2 Removing Covers

This section describes how to remove covers as needed for routine maintenance.

Only the covers listed in this chapter should be removed. Removing other GC covers can compromise the safety features of the GC, leading to personal injury or damage to the instrument.

To Remove the Detector Top Cover

This cover protects the detectors, valve box, and valve assembly. To remove the detector top cover:

1 Raise it to a vertical position

2 Lift the right side and disengage the pin on the lower left side.

CAUTION Do not force the cover, either when installing it or closing it. This could break the plastic parts.

To Remove the Pneumatics Cover

The pneumatics cover protects the flow manifolds in the back top of the GC.

1. Disconnect any vent tubing connected to the split and septum purge vents.
2. Raise and remove the detector top cover.
3. Remove the screw on the left side of the pneumatics cover that secures the cover to the GC.
4. Loosen the screw on the back of the GC that secures the pneumatics cover to the GC.
5. Lift and remove the cover.

To Remove the Electronics Cover

You may need to remove the electronics cover to perform NPD maintenance.

CAUTION Raising the electronics cover exposes the GC electronics.

1. Raise or remove the detector top cover.
2. If an FPD is installed, remove the PMT tube. See "To Change the FPD Wavelength Filter.
3. If an FPD is installed, remove the heat shield (the metal "bracket" below the PMT tube) by removing the four screws that secure it to the front bracket/support.
4. Remove the screw on the left side of the electronics cover.
5. Loosen the screw on the back of the electronics cover.
6. Remove the cover.

3
Maintaining Capillary Columns

Consumables and Parts for Columns

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 2 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

Table 3 Capillary column hangers

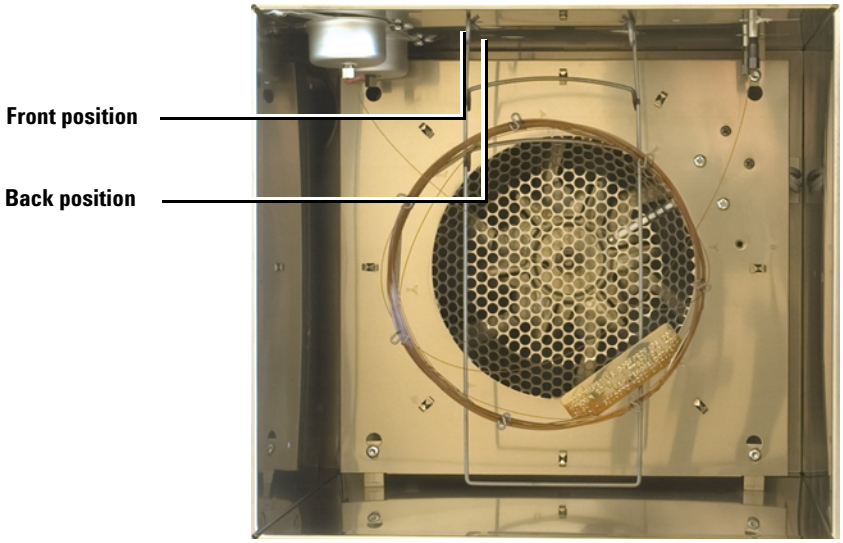
Description	Part Number
Column hanger	1460-1914
Capillary column clip kit, for 7-inch column basket	G1530-61580

To Install a Capillary Column Hanger

WARNING **Be careful! The oven may be hot enough to cause burns. If the oven is hot, wear heat-resistant gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

1 Select either the front or back hanger position. (Hanger is shown in back position.)



2 Insert the ends of the hanger into the slots in the selected position.

To Condition a Capillary Column

1 Gather the following:

- One 7/16-inch, and 1/4-inch wrenches
- No-hole ferrule (See "Consumables and Parts for Columns" on page 20.)
- Column nut

WARNING **Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.**

2 Load the GC maintenance method and wait for the GC to become ready.

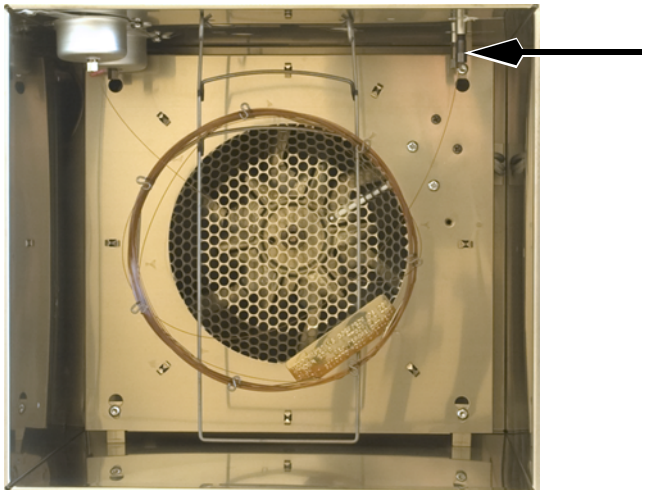
WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

3 Install the column into the inlet using the new ferrules. See:

- To Install a Capillary Column with the Split/Splitless Inlet
- To Install a Capillary Column with the Purged Packed Inlet

4 Cap the detector column fitting.



5 Set a minimum velocity of 30 cm/s, or as recommended by the column manufacturer. Let gas flow through the column at room temperature for 15 to 30 minutes to remove air.

6 Program the oven from room temperature to the maximum temperature limit for the column. Increase the temperature at a rate of 10 to 15 °C/min. Hold at the maximum temperature for 30 minutes.

7 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

8 Attach the column to the detector. For details, select your specific detector from the following list:

- To Install a Capillary Column in the FID
- To Install a Capillary Column in the NPD
- To Install a Capillary Column in the TCD
- To Install a Capillary Column in the uECD
- To Install a Capillary Column Adapter in the FPD

9 Restore the analytical method.
   - For FID or FPD, immediately turn off the flame.
   - For NPD, immediately turn off the bead.

10 After the GC becomes ready, wait 10 minutes, then ignite the detector flame or bead.

To Cut a Loop from a Column

1 Gather the following:
   - New ferrule(s) for the column inlet connection
   - Column cutter

2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

3 Loosen the inlet column nut and remove the column from the inlet.

4 Uncoil one loop of column from the column hanger.

5 Cut the unwanted loop from the column.

6 Install the column into the inlet using the new ferrules. See:
   - To Install a Capillary Column with the Split/Splitless Inlet
   - To Install a Capillary Column with the Purged Packed Inlet

To Reverse a Column and Bakeout Contaminants

1 Gather the following:
- 1/4-inch wrench
- Column cutter

2 Load the maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

3 Disconnect the column from the inlet and detector.

4 If necessary, cut a loop from the column. (See "To Cut a Loop from a Column" on page 26.) Do not attach the column to the inlet.

5 Remove the column from the hanger and reverse its position (inlet and detector ends) and place the column back on the hanger.

6 Attach the column to the inlet.

Select your specific inlet from the following list:
- To Install a Capillary Column with the Split/Splitless Inlet
- To Install a Capillary Column with the Purged Packed Inlet

7 Attach your column to the detector.

Select your specific detector from the following list:
- To Install a Capillary Column in the FID
- To Install a Capillary Column in the NPD
- To Install a Capillary Column in the TCD
- To Install a Capillary Column in the uECD
- To Install a Capillary Column Adapter in the FPD

8 Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.

   For Split/Splitless inlets, select split mode and set the split vent flow to 200 mL/min.

9 Purge the column with carrier flow for at least 10 minutes before heating the oven.

10 Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature.

11 Set the column oven 25 °C above the GC method final oven temperature to bake contaminants out of the inlet, mostly through the split vent. Do not exceed the column manufacturer's maximum temperature limit.

12 Bakeout for 30 minutes.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4
Maintaining the Split/Splitless Inlet

Consumables and Parts for the Split/Splitless Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 4 Split, splitless, direct, and direct connect inlet liners

Mode	Description	Deactivated	Part number
Split	Low-pressure drop, glass wool, single taper, 870 µL	Yes	5183-4647
Split	Glass wool, 990 µL	No	19251-60540
Split—Manual only	Empty pin and cup, 800 µL	No	18740-80190
Split—Manual only	Packed pin and cup, 800 µL	No	18740-60840
Splitless	Single taper, glass wool, 900 µL	Yes	5062-3587
Splitless	Single taper, no glass wool, 900 µL	Yes	5181-3316
Splitless	Dual taper, no glass wool, 800 µL	Yes	5181-3315
Splitless—Direct inject	2-mm id, quartz, 250 µL	No	18740-80220
Splitless—Direct inject	2-mm id, 250 µL	Yes	5181-8818
Direct inject —Headspace or purge and trap	1.5-mm id, 140 µL	No	18740-80200
Direct column connect	Single taper, splitless 4-mm id	Yes	G1544-80730
Direct column connect	Dual taper, splitless 4-mm id	Yes	G1544-80700

Table 5 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292

Table 5 Nuts, ferrules, and hardware for capillary columns (continued)

Column id (mm)	Description	Typical use	Part number/quantity
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

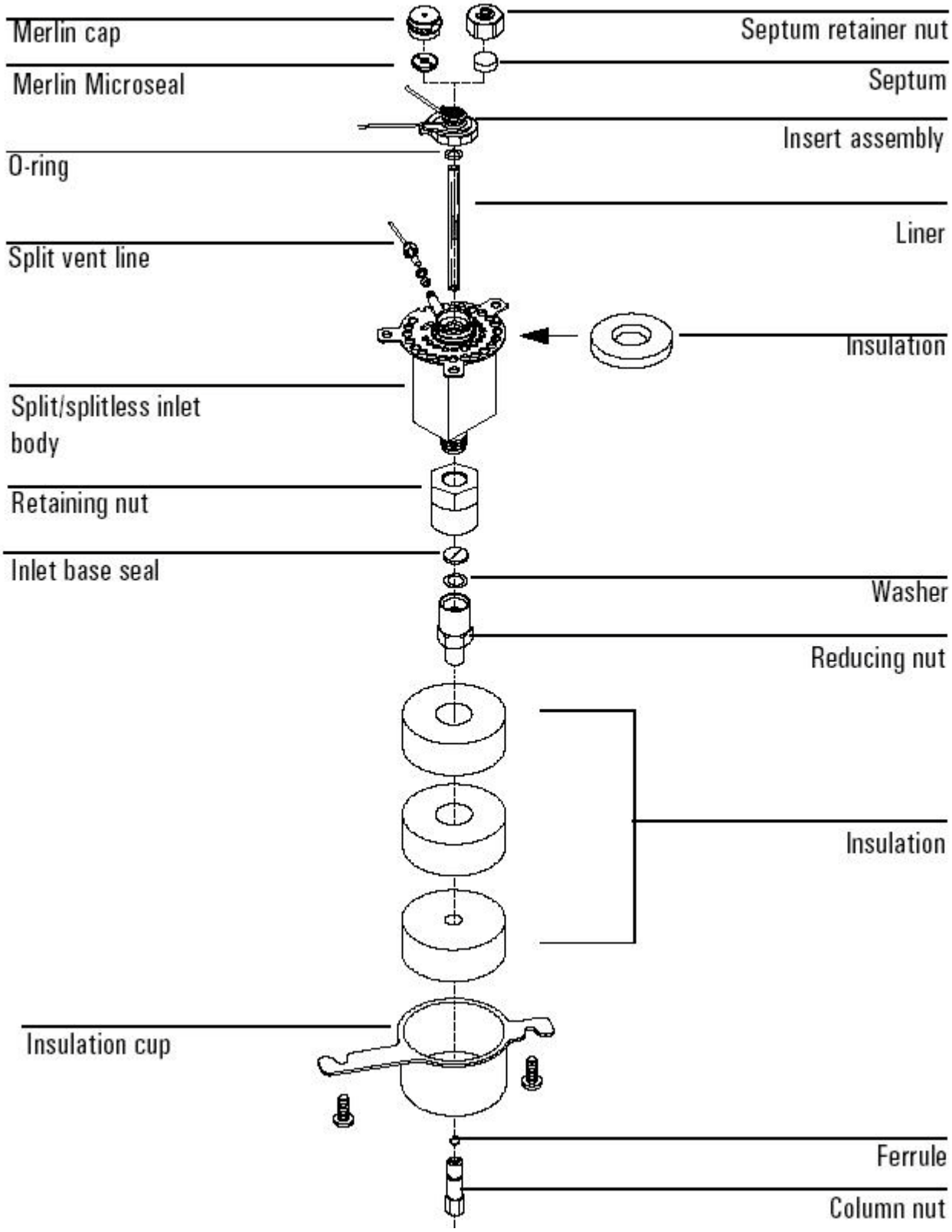
Table 6 Other consumables and parts for the split/splitless inlet

Description/quantity	Part number
Septum retainer nut for headspace	18740-60830
Septum retainer nut	18740-60835
11-mm septum, high-temperature, low-bleed, 50/pk	5183-4757
11-mm septum, prepierced, long life, 50/pk	5183-4761
Merlin Microseal septum (high-pressure)	5182-3444
Merlin Microseal septum (30 psi)	5181-8815
Nonstick fluorocarbon liner O-ring (for temperatures up to 350 °C), 10/pk	5188-5365
Nonstick fluorocarbon liner O-ring for Flip Top Inlet Sealing System, 10/pk	5188-5366
Graphite O-ring for split liner (for temperatures above 350 °C), 10/pk	5180-4168

Table 6 Other consumables and parts for the split/splitless inlet

Description/quantity	Part number
Graphite O-ring for splitless liner (for temperatures above 350 °C), 10/pk	5180-4173
Split vent trap PM kit, single cartridge	5188-6495
Retaining nut	G1544-20590
Gold-plated seal (standard application)	5188-5367
Gold-plated seal with cross (high split flows) (includes SS washer)	5182-9652
Stainless steel washer (0.375-inch od), 12/pk	5061-5869
Reducing nut	18740-20800
Column nut, blanking plug	5020-8294
Capillary inlet preventative maintenance kit, split	5188-6496
Capillary inlet preventative maintenance kit, splitless	5188-6497

Exploded Parts View of the Split/Splitless Inlet



To Install a Capillary Column with the Split/Splitless Inlet

WARNING **Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.**

1 Gather the following (see "Consumables and Parts for the Split/Splitless Inlet" on page 30):
   - Column
   - Ferrule(s)
   - Column nut
   - Septum
   - Column cutter
   - Isopropanol
   - Lab tissue
   - Metric ruler
   - 1/4-inch open-end wrench
   - Lint-free gloves
2 Load the GC maintenance method and wait for the GC to become ready.

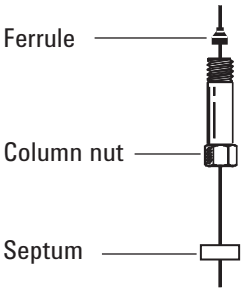
WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

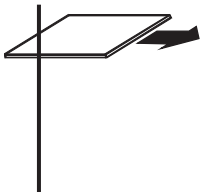
3 Verify that the correct glass liner is installed. (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
4 Place the column on the hanger with the ends pointing up and the label to the front.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

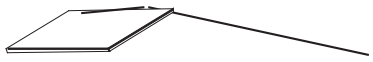
5 Place a septum, capillary column nut, and ferrule on the column.



6 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

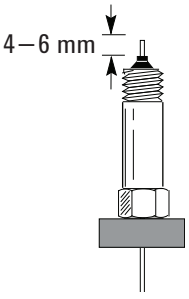


7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

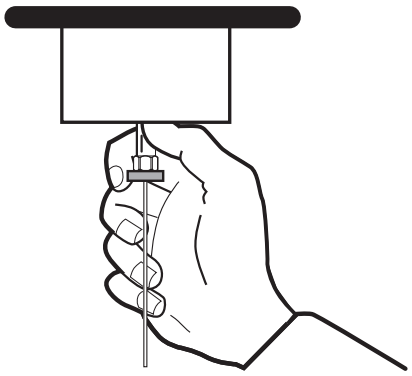


8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

9 Position the column so it extends 4 to 6 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this position.



10 Thread the column nut into the inlet but do not tighten.



11 Adjust the column position so that the septum contacts the bottom of the column nut. Finger-tighten the column nut until it begins to grip the column.

12 Tighten the column nut an additional 1/4 to 1/2 turn with a wrench so that the column cannot be pulled from the fitting with gentle pressure.

13 Configure the new column.

14 Condition the column per the manufacturer's recommendation. (See To Condition a Capillary Column.)

15 Install the column into the detector. See:

- To Install a Capillary Column in the FID
- To Install a Capillary Column in the NPD
- To Install a Capillary Column in the TCD
- To Install a Capillary Column in the uECD
- To Install a Capillary Column in the FPD

16 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.

17 Restore the analytical method.

- For FID or FPD, immediately turn off the flame.
- For NPD, immediately turn off the bead.

18 After the GC becomes ready, wait 10 minutes then ignite the detector flame or bead.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.**

19 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

To Change the Septum on the Split/Splitless Inlet

1 Gather the following:

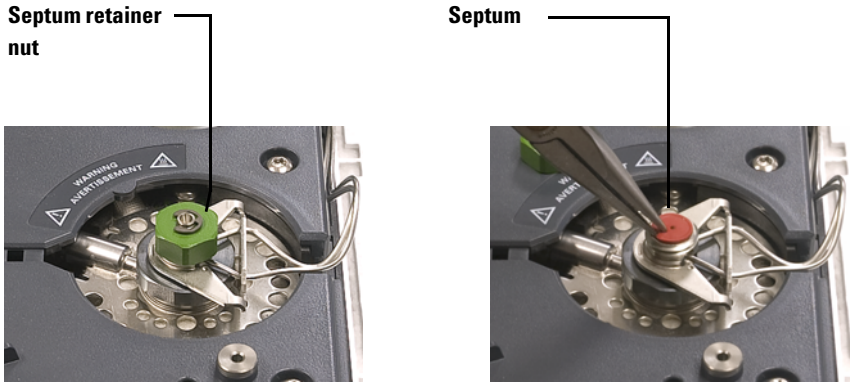
- Replacement septum. (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
- 0- or 00-grade steel wool (optional)
- Tweezers

2 Load the inlet maintenance method and wait for the GC to become ready.

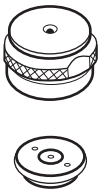
WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the septum retainer nut or Merlin cap.

4 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.

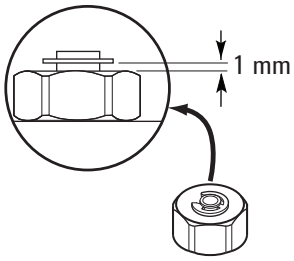


5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).



6 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

CAUTION Overtightening the septum nut can cause contamination.



7 Restore the analytical method.

8 Reset the septum counter.

To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet

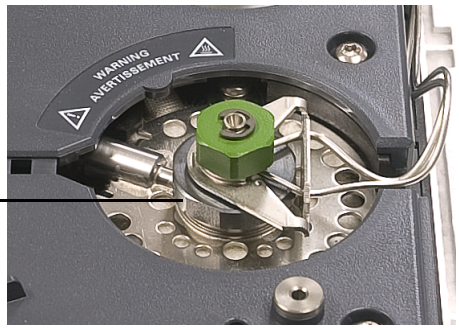
1 Gather the following:

- Replacement septum (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
- 0- or 00-grade steel wool (optional)
- Tweezers
- Compressed, filtered, dry air or nitrogen

2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

3 Unscrew the insert nut from the inlet body. Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.



4 Remove the septum retainer nut or Merlin cap.

5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. (See "To Change the Septum on the Split/Splitless Inlet" on page 38.)

6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.

7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.

8 Replace the insert retainer nut, tightening it to firm finger-tightness. Do not overtighten.

9 Firmly press the new septum or Merlin Microseal into the fitting. (See "To Change the Septum on the Split/Splitless Inlet" on page 38.)

10 Replace the septum retainer nut or Merlin cap and finger-tighten. (See "To Change the Septum on the Split/Splitless Inlet" on page 38.)

11 Restore the analytical method.

To Change the Liner and O-Ring on the Split/Splitless Inlet

1 Gather the following:

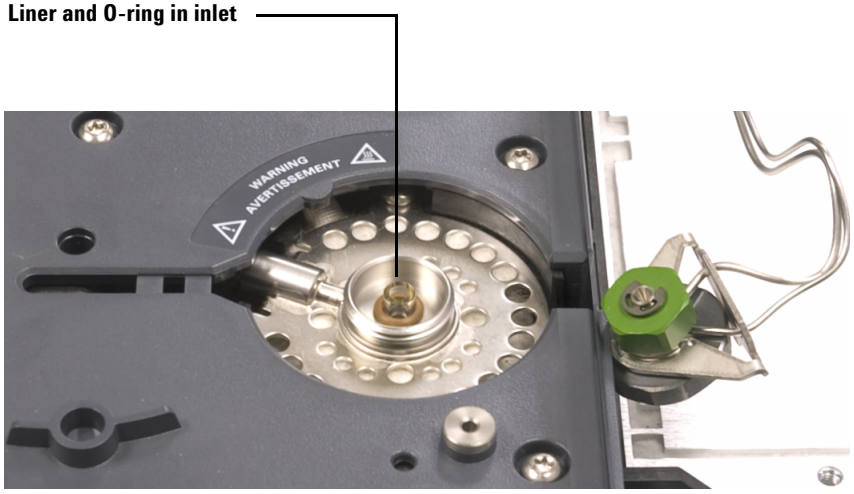
- Replacement O-ring (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
- Replacement liner
- Tweezers
- Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

3 Unscrew the insert nut from the inlet body. Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.

If using a Flip-Top inlet, lift the lever arm.



4 Loosen the O-ring from the sealing surface with tweezers.

5 Grasp the liner with tweezers and pull it out.

6 Inspect the surface of the gold seal for graphite or rubber septum contamination. If required, replace the gold seal. (See "To Replace the Gold Seal on the Split/Splitless Inlet" on page 44.)

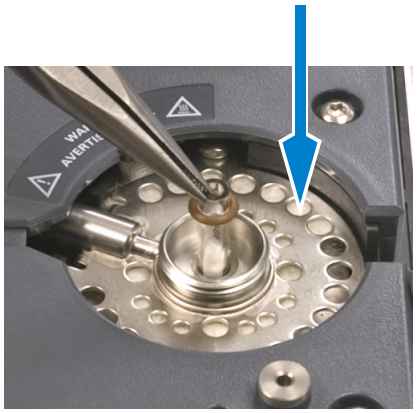
Clean the inlet if there is visible or suspected contamination. (See "To Clean the Split/Splitless Inlet" on page 49.)

Clean O-ring residue from sealing surface.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

7 Slide a new O-ring onto the replacement liner.

8 Return the liner to the inlet, pushing it all the way in until the liner contacts the gold seal.



9 Replace the insert retainer nut, tightening it to firm finger-tightness. Do not overtighten.

If using the Flip-Top inlet, close the lever arm.

10 Turn on the inlet. Allow the inlet and column to purge with carrier gas for 15 minutes before heating the inlet or the column oven.

11 Bakeout contaminants. (See "To Bakeout Contaminants from the Split/Splitless Inlet" on page 51.)

12 Restore the analytical method.

13 Check for leaks.

14 Reset the liner counter.

To Replace the Gold Seal on the Split/Splitless Inlet

1 Gather the following:

- Replacement gold seal (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
- Replacement washer
- 1/4-inch wrench (for column)
- 1/2-inch wrench
- Lint-free gloves

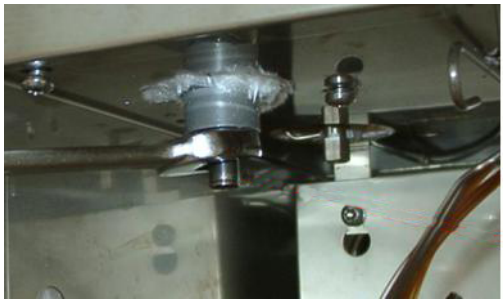
2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the inlet liner.

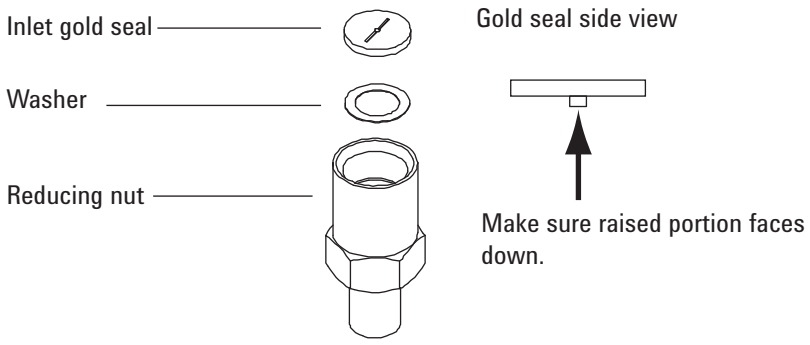
4 Remove the column from the inlet. Cap the open end of the column to prevent contamination. Remove the insulation cup around the base of the inlet.

5 Loosen and remove the reducing nut. Remove the washer and seal inside the reducing nut.



CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

6 Put on gloves to protect the new gold seal and washer from contamination. Put a new washer in the reducing nut and place the new gold seal on top of it (raised portion facing down).



7 Replace the reducing nut and tighten securely with a wrench.

8 Replace the inlet liner.

9 Install the column and the insulation cup.

10 Bakeout contaminants. (See "To Bakeout Contaminants from the Split/Splitless Inlet" on page 51.)

11 Restore the analytical method.

12 Check for leaks.

To Replace the Filter in the Split Vent Line

1 Gather the following:
   - New filter cartridge. (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
   - T-20 Torx screwdriver.

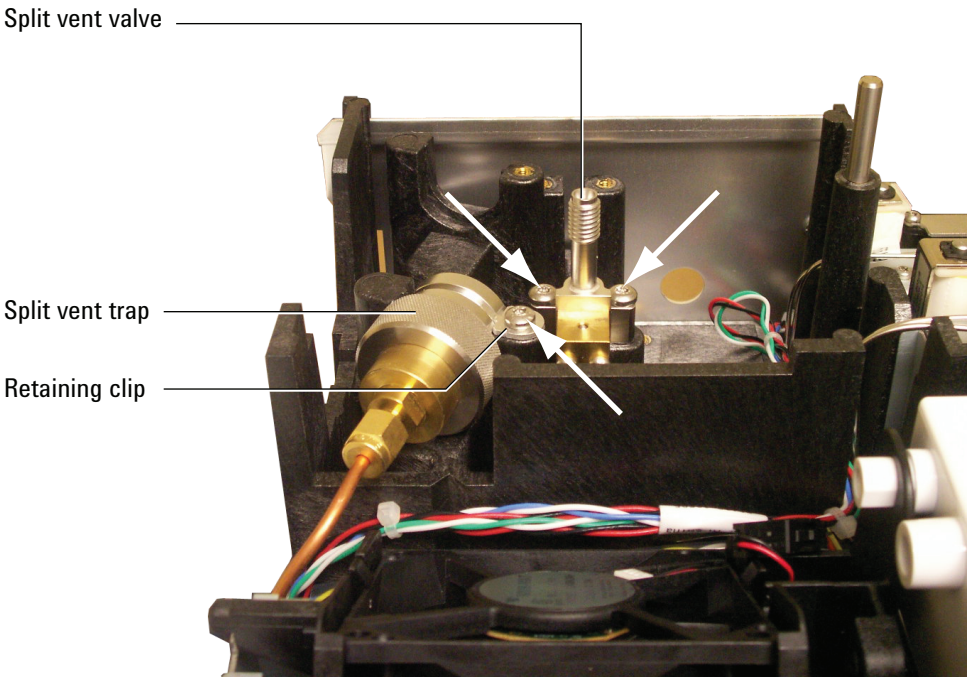
2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

WARNING **The split vent trap may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company's safety procedures for handling these types of substances while replacing the trap filter cartridge.**

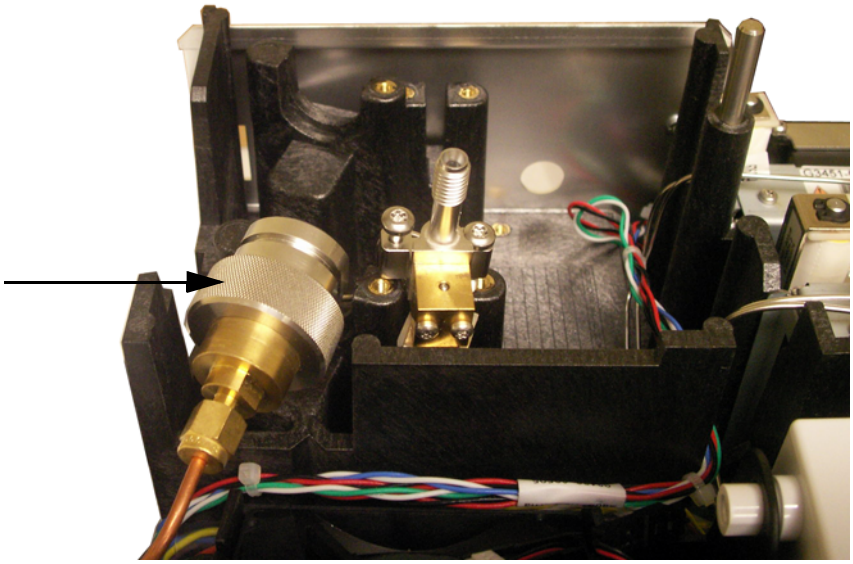
3 Remove the pneumatics cover (top, back of GC).

4 Remove the retaining clip.

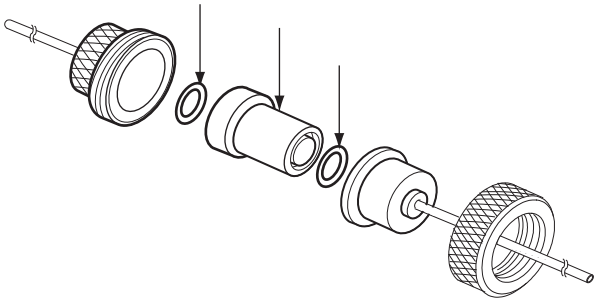


5 Completely loosen the two screws that secure the split vent valve in place.

6 Lift the filter trap assembly and split vent valve from the mounting bracket together and unscrew the split vent front weldment on the filter trap assembly. Be careful not to stress the tubing between the split vent valve and the trap.



7 Remove the old filter cartridge and two O-rings.



8 Verify the new O-rings are seated properly on the new filter cartridge.

9 Install the new filter cartridge then reassemble the trap. Do not fully tighten yet.

10 Place the filter trap assembly in the mounting bracket and install the retaining clip.

11 Install the split vent valve.

12 Fully tighten the split vent front weldment onto the trap.

13 Check for leaks.

14 Restore the analytical method.

15 Reset the split vent trap counter.

16 Install the pneumatics cover.

To Clean the Split/Splitless Inlet

1 Gather the following:

- Replacement septum (See "Consumables and Parts for the Split/Splitless Inlet" on page 30.)
- Replacement liner
- Replacement O-ring
- Replacement gold seal
- Replacement washer
- Solvent that will clean the type of deposits in your inlet
- Compressed, filtered, dry air or nitrogen
- Beaker
- Cleaning brushes—The FID cleaning kit (part number 9301-0985) contains appropriate brushes
- Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the inlet liner. (See "To Change the Liner and O-Ring on the Split/Splitless Inlet" on page 42.)

4 Disconnect the column from the inlet.

5 Remove the reducing nut and gold seal. (See "To Replace the Gold Seal on the Split/Splitless Inlet" on page 44.)

6 Place a beaker in the oven under the inlet to catch the solvent.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

7 Soak a cleaning brush in the solvent and scrub the inside of the inlet weldment. Repeat 10 times.

8 Rinse the inlet with the solvent.

9 Blow the inside of the inlet dry with compressed air or nitrogen.

10 Install the gold seal and reducing nut.

11 Install the liner and O-ring.

12 Install the column. (See "To Install a Capillary Column with the Split/Splitless Inlet" on page 34.)

13 Check for leaks.

14 Bakeout contaminants. (See "To Bakeout Contaminants from the Split/Splitless Inlet" on page 51.)

15 Restore the analytical method.

To Bakeout Contaminants from the Split/Splitless Inlet

1 Put the inlet into split mode.

2 Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.

3 Set the inlet split vent flow to 200 mL/min.

4 Purge the column with carrier flow for at least 10 minutes before heating the oven.

5 If the column is attached to the detector, set the detector 25 °C above normal operating temperature.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.**

If the column is not attached to the detector, cap the detector fitting.

6 Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature to bakeout contaminants from the inlet, mostly through the split vent.

7 Set the column oven 25 °C above the GC method final oven temperature to bake contaminants from the column. Do not exceed the column manufacturer's maximum temperature limit.

8 Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.

4 Maintaining the Split/Splitless Inlet

5
Maintaining the Purged Packed Inlet

Consumables and Parts for the Purged Packed Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 7 Purged packed inlet parts

Description	Part number/quantity
Preventative maintenance kit	5188-6498
Purged packed glass liners and column adapters	
Glass liner	5080-8732 (25/pack) or 5181-3382 deactivated (5/pack)
0.53-mm column adapter	19244-80540
1/8-inch column adapter	19243-80530
1/4-inch column adapter	19243-80540
Recommended septa and O-rings for the purged packed inlet	
11-mm solid septum, low-bleed, red	5181-1263 (50/pk)
11-mm septum with partial through-hole, low-bleed, red	5181-3383 (50/pk)
11-mm septum, low-bleed, gray	5080-8896 (50/pk)
Merlin Microseal septum (30 psi)	5181-8815
11-mm high-temperature silicone septum (350 °C and higher)	5182-0739 (50/pk)
Viton O-ring (Top insert weldment)	5080-8898 (12/pk)

Table 8 Nuts and ferrules for packed columns

Description	Typical use	Part number/quantity
1/8-inch id Swagelok stainless steel nut, front ferrule, back ferrule	1/8-inch column	5080-8751 (20 each/pk)
1/8-inch id Swagelok brass nut, front ferrule, back ferrule	1/8-inch column	5080-8750 (20 each/pk)
1/8-inch id Vespel/ graphite ferrule	1/8-inch column	0100-1332 (10/pk)

Table 8 Nuts and ferrules for packed columns (continued)

Description	Typical use	Part number/quantity
1/8-inch id brass tubing nut	1/8-inch column	5180-4103 (10/pk)
1/4-inch id Swagelok stainless steel nut, front ferrule, back ferrule	1/4-inch column	5080-8753 (20 each/pk)
1/4-inch id Swagelok brass nut, front ferrule, back ferrule	1/4-inch column	5080-8752 (20 each/pk)
1/4-inch id Vespel/ graphite ferrule	Inlet/detector liner/adapters 1/4-inch column	5080-8774 (10/pk)
1/4-inch id brass tubing nut	1/4-inch column	5180-4105 (10/pk)

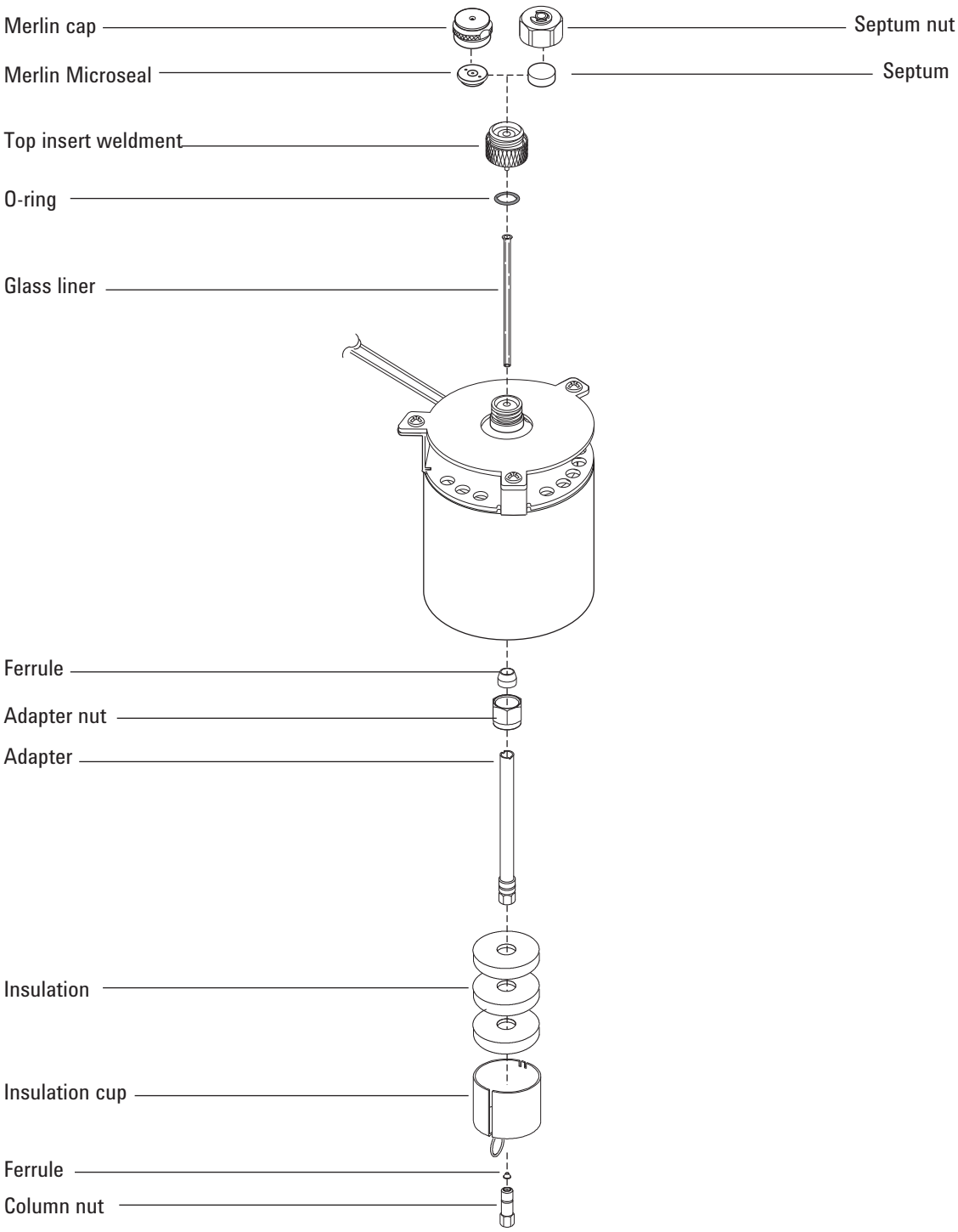
Table 9 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)

Table 9 Nuts, ferrules, and hardware for capillary columns (continued)

Column id (mm)	Description	Typical use	Part number/quantity
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

Exploded Parts View of the Purged Packed Inlet



To Install a Capillary Column with the Purged Packed Inlet

1 Gather the following:
- Column
- Ferrule (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Column nut
- Glass liner
- Viton O-ring
- 0.53-mm column adapter
- Septum
- 1/4-inch wrench
- Metric ruler
- Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

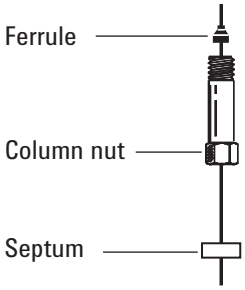
WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

3 Install a 0.53-mm column adapter. (See "To Install an Adapter on the Purged Packed Inlet" on page 66.)

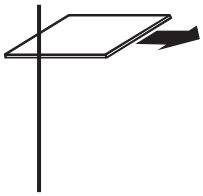
CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4 Install a new Viton O-ring. (See "To Change the O-Ring on the Purged Packed Inlet" on page 68.)

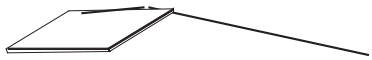
5 Place a septum, capillary column nut, and ferrule on the column.



6 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

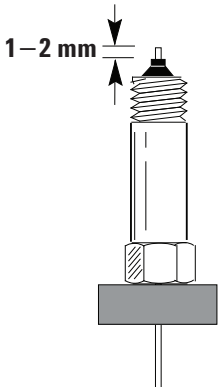


7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

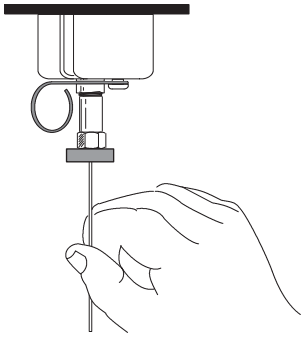


8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

9 Position the column so it extends 1 to 2 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this fixed position.



10 Thread the column nut into the inlet adapter but do not tighten.



11 Adjust the column position so that the septum is even with the bottom of the column nut. Finger-tighten the column nut until it begins to grip the column.

12 Tighten the column nut an additional 1/4 to 1/2 turn with a wrench so that the column cannot be pulled from the fitting with gentle pressure.

13 Configure the new column.

14 Condition the column per the manufacturer's recommendation. (See To Condition a Capillary Column.)

15 Install the column into the detector. See:

- To Install a Capillary Column in the FID
- To Install a Capillary Column in the NPD
- To Install a Capillary Column in the TCD
- To Install a Capillary Column in the uECD
- To Install a Capillary Column Adapter in the FPD

16 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.

17 Restore the analytical method.

- For FPD, immediately turn off the flame.
- For NPD, immediately set the bead voltage to 0.0.

18 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

19 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

To Change the Septum on the Purged Packed Inlet

1 Gather the following:

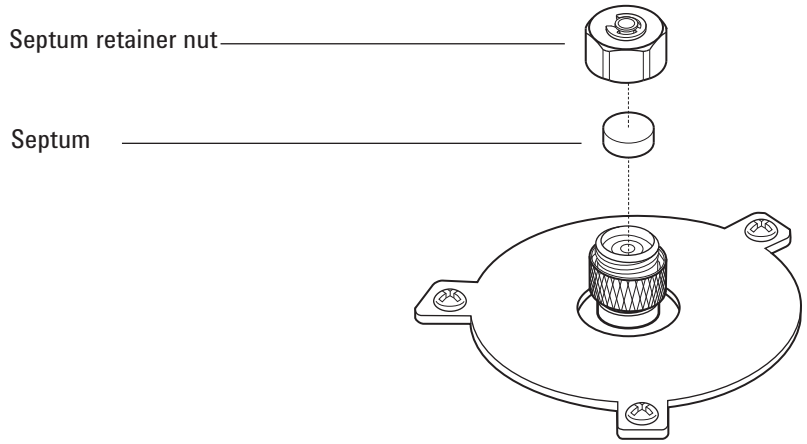
- Replacement septum (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Septum nut wrench
- 0- or 00-grade steel wool (optional)
- Tweezers

2 Load the inlet maintenance method and wait for the GC to become ready.

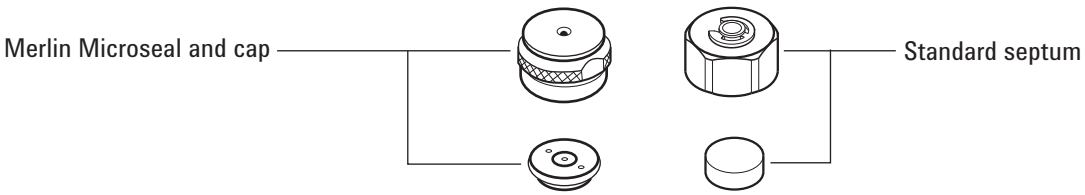
WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the septum retainer nut or Merlin cap.

4 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.

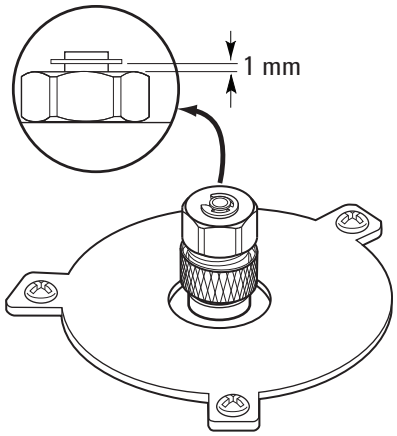


5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).



6 Replace the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

CAUTION Overtightening the septum nut can cause contamination.



7 Restore the analytical method.

8 Reset the septum counter.

To Clean the Septum Seat in the Purged Packed Inlet

1 Gather the following:
   - Replacement septum (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
   - Septum nut wrench
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Ultrasonic cleaning bath
   - Lint-free gloves
2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the septum retainer nut or Merlin cap.
4 Loosen the top insert weldment and remove.

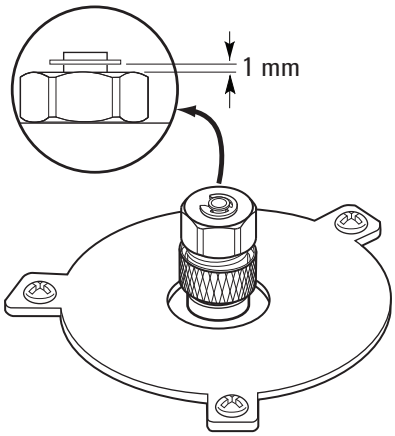
CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5 Use tweezers to remove the septum or Merlin Microseal from the top insert weldment. Do not gouge or scratch the interior of the septum head.
6 Scrub the residue from the top insert weldment and septum nut with a small piece of rolled-up steel wool and tweezers. Ultrasonically clean the retainer nut and top insert weldment.
7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.
8 Wearing gloves, inspect the O-ring and replace, if necessary. (See "To Change the O-Ring on the Purged Packed Inlet" on page 68.)
9 Install the top insert weldment and hand-tighten firmly.

10 Firmly press the new septum or Merlin Microseal into the fitting.

11 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

CAUTION Overtightening the septum nut can cause contamination.



12 Restore the analytical method.

13 Reset the septum counter.

To Install an Adapter on the Purged Packed Inlet

1 Gather the following:

- Brass tubing nut (see "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Adapter (0.53 mm, 1/8-inch packed, or 1/4-inch packed)
- 7/16-inch and 9/16-inch wrench
- Vespel/graphite ferrule
- Methanol
- Lint-free gloves

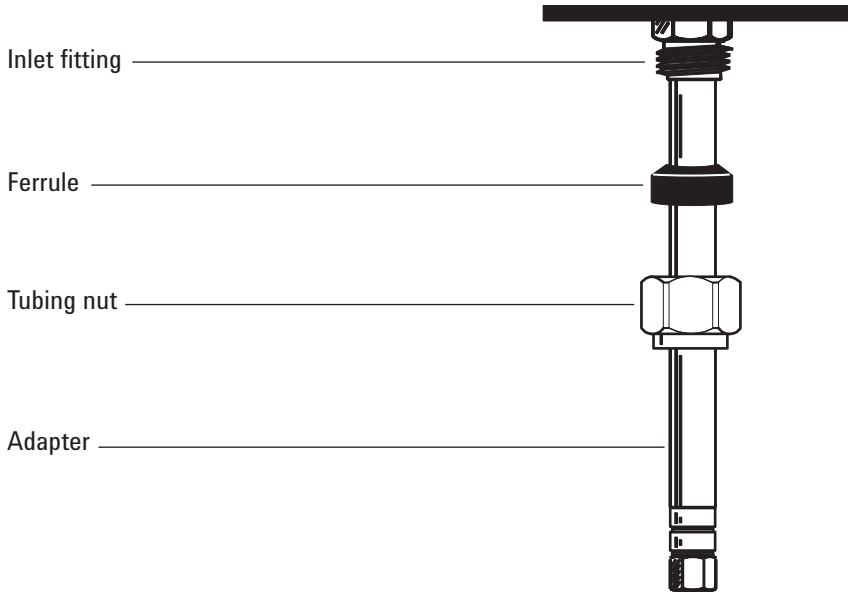
2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Clean the end of the adapter with a lint-free cloth and methanol to remove contamination such as fingerprints.

4 Place the tubing nut and Vespel/graphite ferrule on the adapter.



5 Insert the adapter straight into the inlet base as far as possible.

6 Hold the adapter in this position and finger-tighten the nut.

7 Tighten an additional 1/4 turn with a wrench.

To Change the O-Ring on the Purged Packed Inlet

1 Gather the following:

- Replacement O-ring (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Septum nut wrench
- Tweezers
- Lint-free gloves

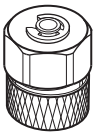
2 Load the inlet maintenance method and wait for the GC to become ready.

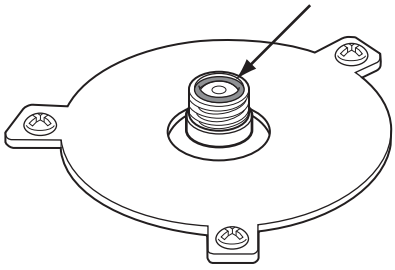
WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Loosen the top insert weldment to remove the top portion of the inlet.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4 Use tweezers to remove the old O-ring.





5 Insert a new O-ring.

6 Install and tighten the top insert weldment.

7 Restore the analytical method.

To Change the Glass Liner on the Purged Packed Inlet

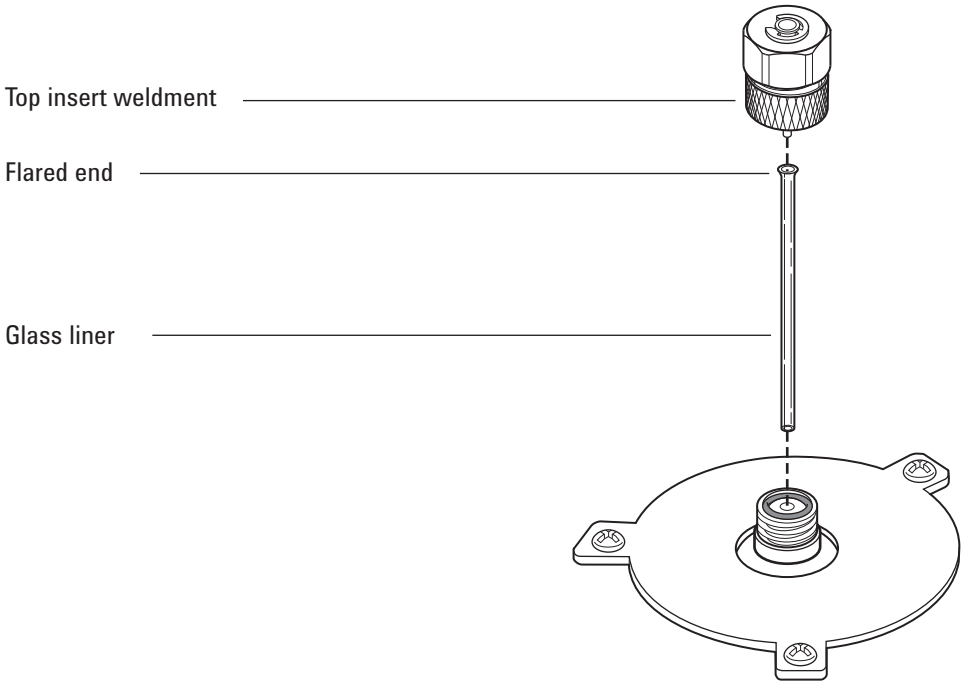
1 Gather the following:

- Replacement glass liner (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- 9/16-inch wrench
- Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Loosen the top insert weldment to remove the top portion of the inlet.



4 Use a thin wire or wood splint to carefully lift and remove the old glass liner.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5 Wearing gloves, inspect the O-ring and replace, if necessary. (See "To Change the O-Ring on the Purged Packed Inlet" on page 68.)

6 Wearing gloves, grasp the flared end (top) of the replacement glass liner with tweezers and install it in the inlet. If the glass liner does not seat properly because a capillary column is installed, remove the column, install the glass liner, and replace the column. (See "To Install a Capillary Column with the Purged Packed Inlet" on page 58.)

7 Install the top insert weldment and hand-tighten firmly.

8 Restore the analytical method.

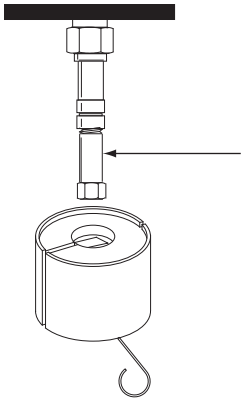
9 Set the liner counter.

To Install an Insulation Cup on the Purged Packed Inlet

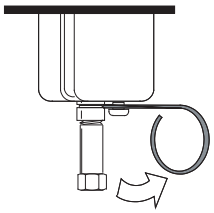
1 Gather the following:

- No-hole ferrule
- Column nut

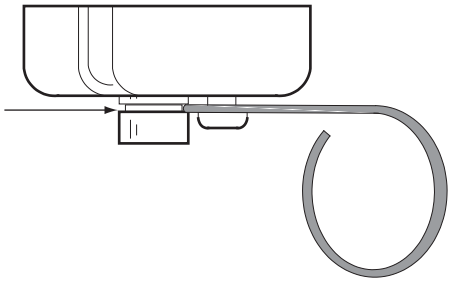
2 Install a plug (for example, a column nut with no-hole ferrule) in the inlet capillary adapter.



3 Push the cup spring to the right. Slide the cup over the inlet fitting so that the insulation at the top of the cup is flush against the oven roof.



4 Place the spring into the groove in the inlet liner. Remove the column nut and no-hole ferrule.



To Clean the Purged Packed Inlet

1 Gather the following:
   - Replacement O-ring (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
   - Replacement glass liner
   - Replacement septum
   - Solvent that will clean the type of deposits in your inlet
   - Compressed, filtered, dry air or nitrogen
   - Beaker
   - Cleaning brushes—The FID cleaning kit (part number 9301-0985) contains appropriate brushes
   - Lint-free gloves
2 Load the inlet maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the column.
4 Remove the septum nut and septum.
5 Remove the top insert weldment.
6 Remove the glass liner and O-ring.
7 If used, remove the adapter.
8 Ultrasonically clean the septum nut, top insert weldment, and adapter (if used) in a suitable solvent.
9 Place a beaker in the oven under the inlet to catch the solvent.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

10 Soak a cleaning brush with the solvent and vigorously scrub the interior walls of the inlet.

11 Blow the inside of the inlet dry with compressed air or nitrogen.

12 Install the adapter, if used. (See "To Install an Adapter on the Purged Packed Inlet" on page 66.)

13 Install the glass liner and O-ring. (See "To Change the Glass Liner on the Purged Packed Inlet" on page 69.)

14 Install the top insert weldment and finger-tighten.

15 Install the septum and septum nut. (See "To Change the Septum on the Purged Packed Inlet" on page 62.)

16 Attach the column. (See "To Install a Capillary Column with the Purged Packed Inlet" on page 58.)

17 Check for leaks.

18 Restore the analytical method.

19 Set the septum and glass liner counters.

To Bakeout Contaminants from the Purged Packed Inlet

1. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
2. Purge the column with carrier flow for at least 10 minutes before heating the oven.
3. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.

   If the column is not attached to the detector, cap the detector fitting.
4. Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature.
5. Set the column oven 25 °C above the GC method final oven temperature to bake contaminants out of the inlet. Do not exceed the column manufacturer's maximum temperature limit.
6. Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.

To Install a Packed Metal Column

1 Gather the following:
   - 7/16-inch, 9/16-inch, and 1/2-inch wrenches
   - Lint-free gloves
2 Load the GC maintenance method and wait for the GC to become ready.
3 Prepare the packed metal column. (See "To Install Ferrules on a Packed Metal Column" on page 84.)

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

4 Install the 1/8-inch or 1/4-inch packed column inlet adapter, if necessary. (See "To Install an Adapter on the Purged Packed Inlet" on page 66.)

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5 Attach the column to the inlet adapter. Finger-tighten the nut.
6 Tighten the nut an additional 1/4 turn with a wrench (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

   Use two wrenches, one on the column nut and the other on the adapter, to prevent the adapter from rotating.
7 Configure the new packed column (make sure either column length or diamter is zero).

WARNING **Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.**

8 Condition the column, if necessary. (See "To Condition a Packed Column" on page 82.)
9 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

10 If required, install the detector adapter. (See "To Install a Packed Column Adapter on a Detector Fitting" on page 77.)

11 Attach the column to the detector or detector adapter. Finger-tighten the nut.

12 Tighten the nut an additional 1/4 turn with a wrench (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

13 Establish a flow of carrier gas and purge as recommended by the packing manufacturer. Generally:

- 20 to 30 mL/min for 2-mm id glass or 1/8-inch od metal columns
- 50 to 60 mL/min for 4-mm id glass or 1/4-inch od metal columns

14 Restore the analytical method.

- For NPD, immediately set the bead voltage to 0.0.

15 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

16 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

To Install a Packed Column Adapter on a Detector Fitting

1 Gather the following:

- 7/16-inch, 9/16-inch, and 1/2-inch wrenches
- Vespel/graphite ferrule (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Brass column nut
- Lint-free gloves
- Adapter.

Select the appropriate adapter from one of the parts lists shown below:

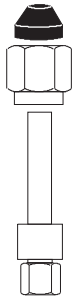
- Consumables and Parts for the FID (Packed columns can only be installed on an adaptable FID.)
- Consumables and Parts for the TCD
- Consumables and Parts for the NPD

2 Load the GC maintenance method and wait for the GC to become ready.

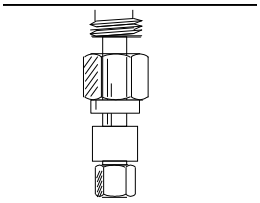
WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble a nut and a ferrule onto the adapter.



4 Insert the adapter straight into the detector base as far as possible.



5 Hold the adapter in this position and finger-tighten the nut.

6 Tighten an additional 1/4 turn with a wrench (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

To Install a Packed Glass Column

1 Gather the following:

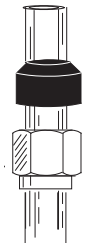
- 9/16-inch wrench
- Two 1/4-inch brass nuts (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Two 1/4-inch Vespel/graphite ferrules
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble a brass nut and Vespel/graphite ferrule on each end of the column.



Glass columns must be simultaneously inserted into the inlet and detector and installed parallel to the oven door. When conditioning the column, do not attach the column to the detector.

4 If conditioning the column, insert the column into the purged packed inlet until it bottoms. Withdraw the column 1 to 2 mm. Finger-tighten the inlet column nut. (See "To Condition a Packed Column" on page 82.)

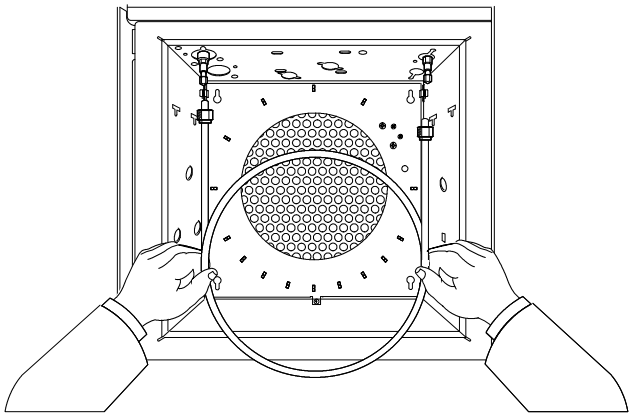
CAUTION Overtightening the column nut or forcing it to bottom in either the inlet or detector may shatter the column.

5 Tighten the inlet column nut 1/4 turn with a wrench.

WARNING **Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.**

6 After conditioning, remove the column from the inlet.

7 Simultaneously insert the column into the inlet and detector fittings but *do not* force it. It may be necessary to start the long end of the column in the inlet at an angle to clear the oven floor.



8 Withdraw the column 1 to 2 mm from both the inlet and detector. Finger-tighten both column nuts.

CAUTION Overtightening the column nut or forcing it to bottom in either the inlet or detector may shatter the column.

9 Tighten both column nuts 1/4 turn with a wrench.

10 Configure the new packed column (make sure either column length or diameter is zero).

11 Establish a flow of carrier gas and purge as recommended by the packing manufacturer. Generally:

- 20 to 30 mL/min for 2-mm id glass or 1/8-inch od metal columns
- 50 to 60 mL/min for 4-mm id glass or 1/4-inch od metal columns

12 Restore the analytical method.

- For NPD, immediately set the bead voltage to 0.0.

13 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

14 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

To Condition a Packed Column

1 Gather the following:

- Capillary adapter, column nut, and no-hole ferrule (for FID and NPD), or 1/8-inch Swagelok cap (for TCD)
- Two 7/16-inch wrenches
- 1/4-inch open-end wrench
- Lint-free gloves

WARNING **Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.**

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Install the proper liner in the inlet and attach the column. (See "To Install a Packed Metal Column" on page 75.)

4 Cap the detector(s) fittings with the capillary adapter, no-hole ferrule and column nut (FID and NPD) or 1/8-inch cap (TCD).

5 Enter a column flow as recommended by the packing manufacturer or an appropriate flow as follows:

- 20 to 30 mL/min for 2-mm id glass or 1/8-inch od metal columns
- 50 to 60 mL/min for 4-mm id glass or 1/4-inch od metal columns

6 Raise the oven temperature slowly to the conditioning temperature for the column. The conditioning temperature is never higher than the maximum temperature limit for

the column; 30 °C less than the maximum is usually sufficient.

7 Continue conditioning overnight at the final temperature. Cool the oven to room temperature with carrier flow on.

8 Attach the column to the detector and maintain established flow. (See "To Install a Packed Metal Column" on page 75.)

To Install Ferrules on a Packed Metal Column

1 Gather the following:

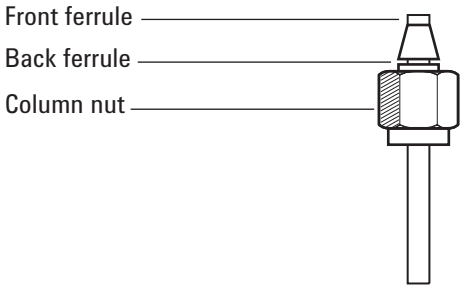
- Wrenches
- Stainless steel male Swagelok fitting, 1/4- or 1/8-inch od
- Brass Swagelok nut and ferrule set (See "Consumables and Parts for the Purged Packed Inlet" on page 54.)
- Lint-free gloves

2 Verify that the column end is cut square and is free of burns and deformation.

3 Secure the fitting in a bench vise.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

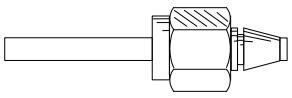
4 Assemble a Swagelok nut and ferrules onto the column.



5 Fully insert the column into the vise-held fitting, then withdraw 1–2 mm. Finger-tighten the nut.

6 Tighten the nut an additional 3/4 turn with a wrench (for a 1/8-inch column) or an additional 1-1/4 turn (for a 1/4-inch column).

7 Unscrew the column nut from the vise-held fitting and remove the column. Ferrules should now be set in place on the column with the column end correctly positioned.



6
Maintaining the FID

Consumables and Parts for the FID

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 10 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

Table 11 FID parts and subassemblies

Description	Part number/quantity
Screw, M4 × 25 mm, Torx, T20	0515-2712 (3/pk)
PTFE chimney (optional)	19231-21050
Collector assembly	G1531-60690
FID/NPD capillary column adapter	19244-80610
FID/NPD 1/8-inch packed column adapter	19231-80520
FID/NPD 1/4-inch packed column adapter	19231-80530
Insulation	19234-60715 (3/pk)
Insulation cup assembly	19234-60700
Nut, 1/4-inch, brass, for packed column adapters	5180-4105 (10/pk)
Ferrule, Vespel, 1/4-inch, for packed column adapters	5080-8774 (10/pk)

Table 12 Jets for capillary adaptable fittings

Jet type	Part number	Jet tip id	Length
Capillary	19244-80560	0.29 mm (0.011 inch)	61.5 mm
Capillary, high-temperature (use with simulated distillation)	19244-80620	0.47 mm (0.018 inch)	61.5 mm
Packed	18710-20119	0.46 mm (0.018 inch)	63.6 mm
Packed, wide-bore (use with high-bleed applications)	18789-80070	0.76 mm (0.030 inch)	63.6 mm

Table 13 Jets for capillary optimized fittings

Jet type	Part number	Jet tip ID	Length
Capillary	G1531-80560	0.29 mm (0.011 inch)	48 mm
High-temperature (use with simulated distillation)	G1531-80620	0.47 mm (0.018 inch)	48-mm

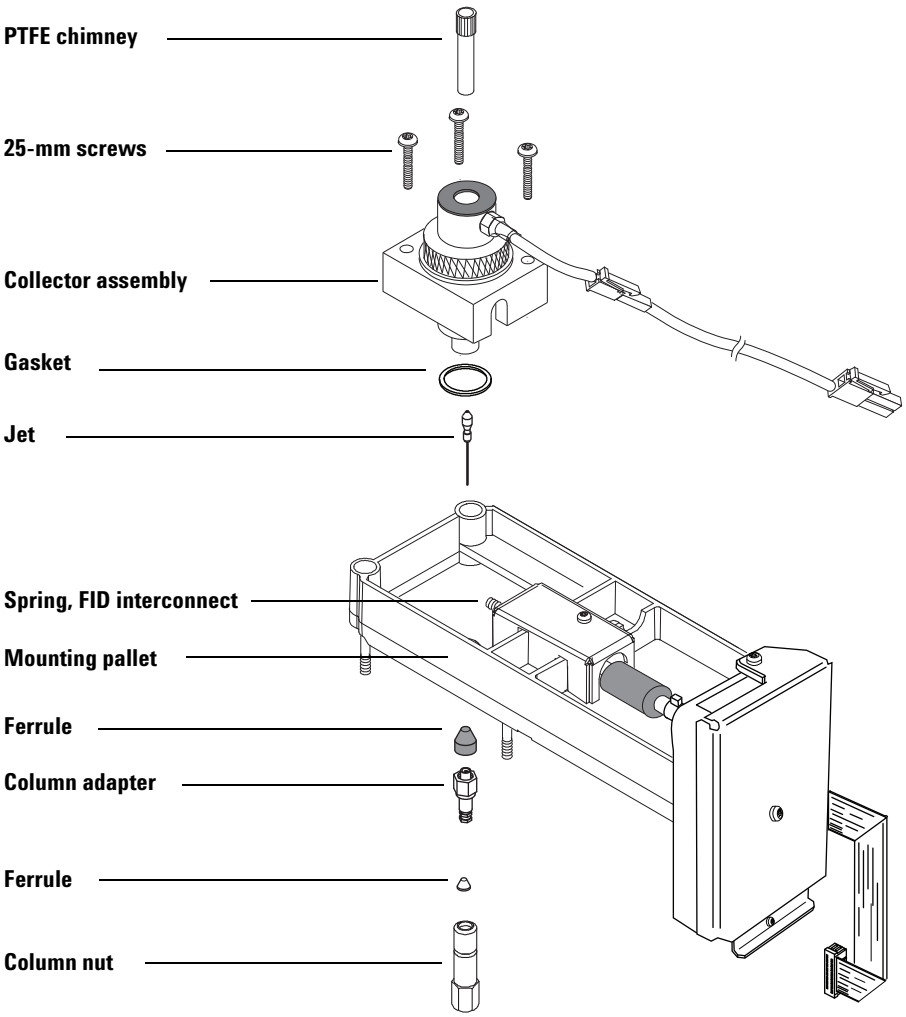
Table 14 FID collector assembly parts

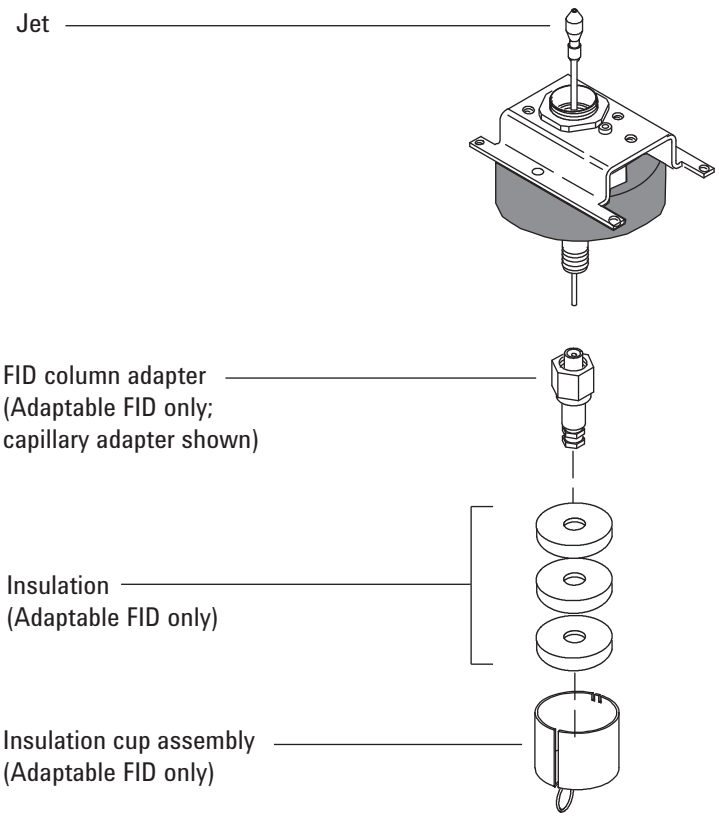
Description	Part number/quantity
Screw, M4 × 25 mm, Torx, T20	0515-2712 (3/pk)
Collector assembly	G1531-60690
Collector nut	19231-20940

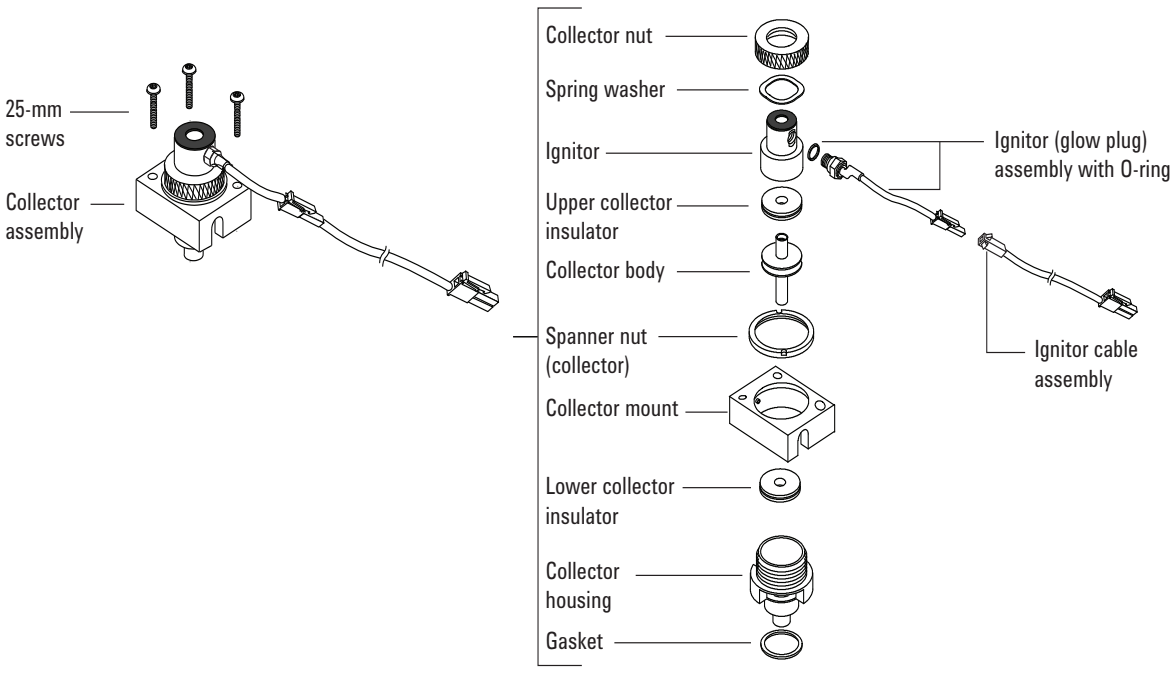
Table 14 FID collector assembly parts (continued)

Description	Part number/quantity
Spring washer	3050-1246
Ignitor castle	19231-20910
Ignitor castle, Hastelloy	19231-21060
Upper/lower collector insulator	G1531-20700
Collector body	G1531-20690
Collector body, Hastelloy	G1531-21090
Spanner nut (collector)	19231-20980
Collector mount	G1531-20550
Collector housing	G1531-20740
Gasket	5180-4165 (12/pk)
Ignitor (glow plug) assembly with O-ring	19231-60680

Exploded Parts Views of the FID

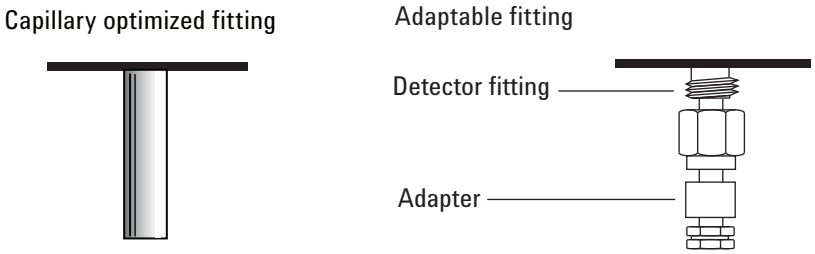



Jet
FID column adapter
(Adaptable FID only;
capillary adapter shown)
Insulation
(Adaptable FID only)
Insulation cup assembly
(Adaptable FID only)


25-mm
screws
Collector
assembly
Collector nut
Spring washer
Ignitor
Upper collector
insulator
Collector body
Spanner nut
(collector)
Collector mount
Lower collector
insulator
Collector
housing
Gasket
Ignitor (glow plug)
assembly with O-ring
Ignitor cable
assembly

Selecting an FID Jet

Open the oven door and locate the column connection fitting at the base of the detector. It will look like either a capillary optimized fitting or an adaptable fitting.



- If you have an application that tends to clog the jet, select a jet with a wider tip id.
- When using packed columns in high column-bleed applications, the jet tends to clog with silicon dioxide.
- In simulated distillation applications, the high-boiling hydrocarbons tend to clog the jet.

For capillary optimized fittings, select a jet from Table 15. For adaptable fittings, select a jet from Table 16.

Table 15 Jets for capillary optimized fittings

Figure 1 ID	Jet type	Part number	Jet tip id	Length
1	Capillary	G1531-80560	0.29 mm (0.011 inch)	48 mm
2	High-temperature (use with simulated distillation)	G1531-80620	0.47 mm (0.018 inch)	48 mm

Figure 1 Capillary optimized jets

Table 16 Jets for capillary adaptable fittings

Figure 2 ID	Jet type	Part number	Jet tip id	Length
1	Capillary	19244-80560	0.29 mm (0.011 inch)	61.5 mm
2	Capillary, high-temperature (use with simulated distillation)	19244-80620	0.47 mm (0.018 inch)	61.5 mm
3	Packed	18710-20119	0.46 mm (0.018 inch)	63.6 mm
4	Packed, wide-bore (use with high-bleed applications)	18789-80070	0.76 mm (0.030 inch)	63.6 mm

Figure 2 Capillary adaptable jets

To Attach a Capillary Column Adapter on an Adaptable FID

1 Gather the following materials:

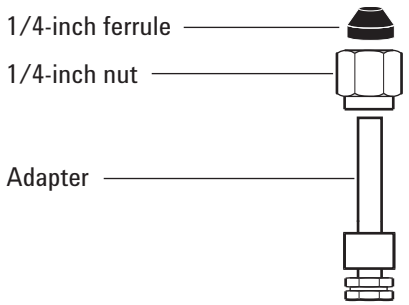
- Adapter (See "Consumables and Parts for the FID" on page 86.)
- 1/4-inch brass nut
- 1/4-inch Vespel/graphite ferrule
- Column cutter
- 1/4-inch wrench
- 9/16-inch open-end wrench
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

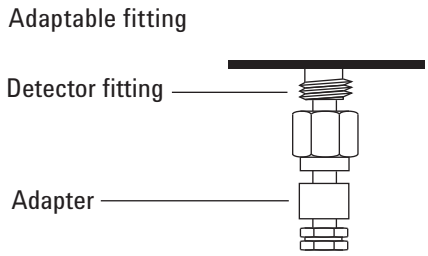
CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble the nut and ferrule onto the adapter.



4 Insert the adapter straight into the detector base as far as possible.

5 Hold the adapter in this position and finger-tighten the nut.



6 Tighten an additional 1/4 turn with a wrench.

To Install a Capillary Column in the FID

1 Gather the following materials (see "Consumables and Parts for the FID" on page 86.):

- Column
- Ferrule(s)
- Column nut
- Column cutter
- 1/4-inch open-end wrench
- Septum
- Isopropanol
- Lab tissue
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

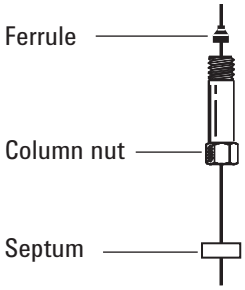
WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

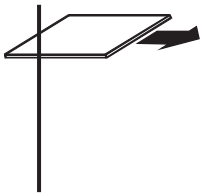
3 If using the adaptable detector, verify that the adapter is installed. (See "To Attach a Capillary Column Adapter on an Adaptable FID" on page 93.)

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

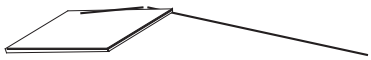
4 Place a septum (if the column id is ≤0.1 mm), capillary column nut, and ferrule on the column.



5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.



6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.



7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

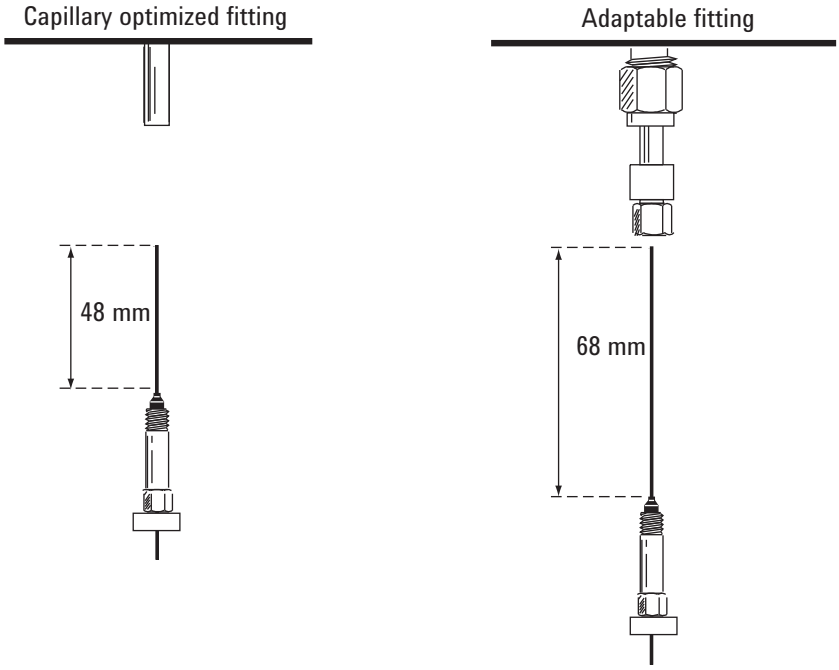
8 Install the capillary column.

If the column id is greater than 0.1 mm:

a Gently insert the column into the detector until it bottoms; do not attempt to force it further.

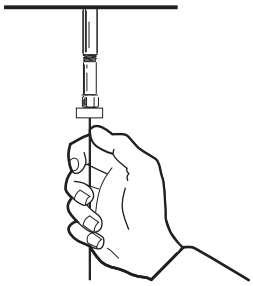
b Finger-tighten the column nut, then withdraw the column about 1 mm. Tighten the nut an additional 1/4 turn with a wrench.

If the column id is 0.1 mm or less position the column so it extends above the ferrule by 48 mm (*capillary optimized* fitting) or 68 mm (*adaptable* fitting). Slide the septum up to hold the column nut and ferrule at this fixed position.



c Insert the column into the detector. Slide the nut and ferrule up the column to the detector base. Finger-tighten the column nut until it grips the column.

d Adjust the column (*not* the septum) position so that the septum is even with the bottom of the column nut. Tighten the nut an additional 1/4 turn with a wrench.



To Replace the FID Collector Assembly

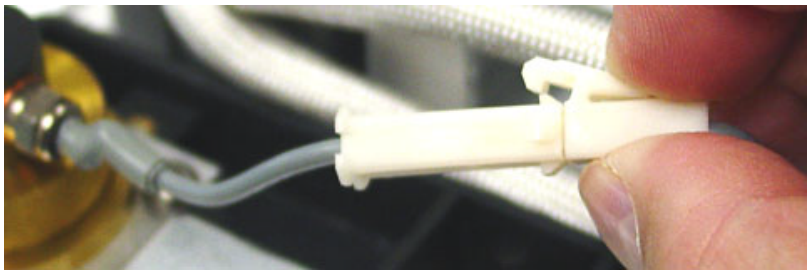
1 Gather the following:

- New FID collector assembly. (See "Consumables and Parts for the FID" on page 86.)
- T-20 Torx screwdriver
- 1/4-inch nut driver
- Tweezers
- Lint-free gloves

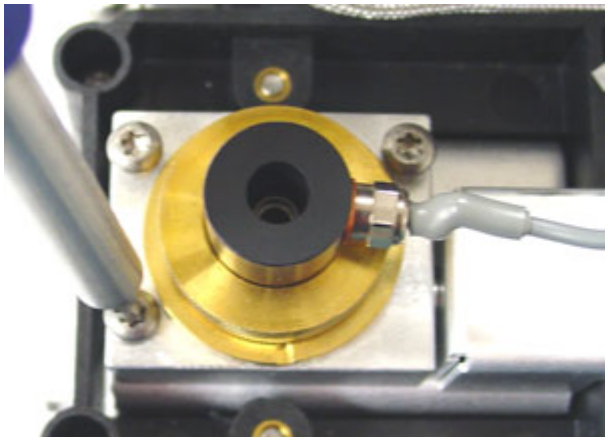
CAUTION To avoid contaminating the FID, wear clean, lint-free gloves when handling the collector assembly.

2 Load the GC maintenance method and wait for the GC to become ready.

3 Disconnect the ignitor cable assembly.

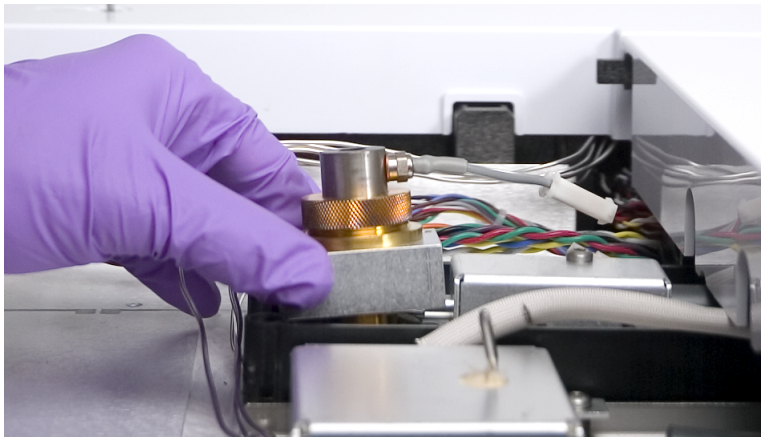


4 Remove the three screws holding the collector assembly to the mounting pallet.



CAUTION This step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.

5 Lift and remove the assembly from the pallet.

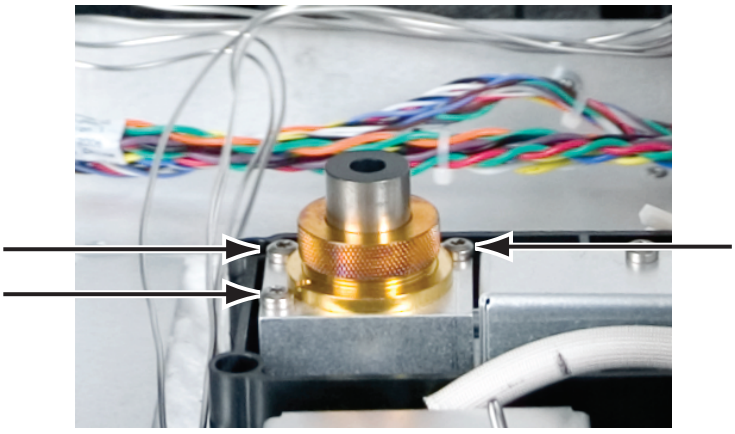


6 Remove the ignitor cable assembly from the new collector assembly, if present.

7 Remove any protective caps from the new collector assembly, if present.

8 Lower the new collector assembly into the housing.

9 Insert the three screws and tighten (to 18 inch-pounds).



10 Connect the ignitor extension cable.

11 Verify assembly:

   a Check the FID leakage current. (See "To Check the FID Leakage Current" on page 112.)

   b Check the FID baseline. (See "To Check the FID Baseline" on page 113.)

To Replace an FID Jet

1 Gather the following:

- Replacement jet (See “Selecting an FID Jet” on page 91.)
- T-20 Torx screwdriver
- 1/4-inch nut driver
- Tweezers
- Compressed, filtered, dry air or nitrogen
- Solvent that will clean the type of deposits in your detector
- Clean cloth
- Cotton swab
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

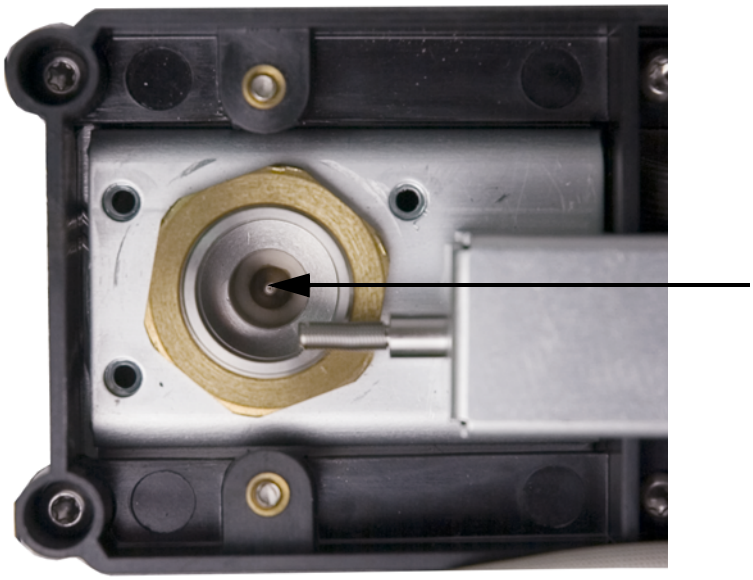
WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

3 If installed, remove the capillary column from the detector.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

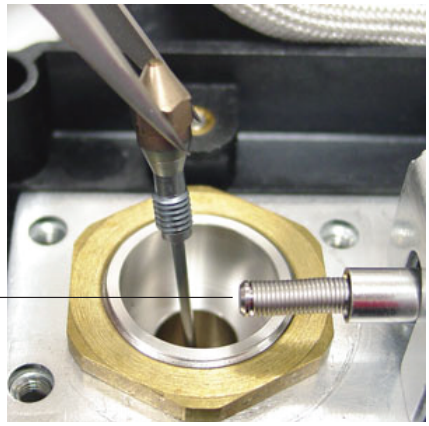
4 Remove the FID collector assembly and place it on a clean cloth. (See “To Replace the FID Collector Assembly” on page 98.)

5 Locate the jet inside the housing.



CAUTION Handle the clean or new jet only with tweezers, or wear gloves.

6 Loosen the jet, then lift it out of the housing with tweezers.

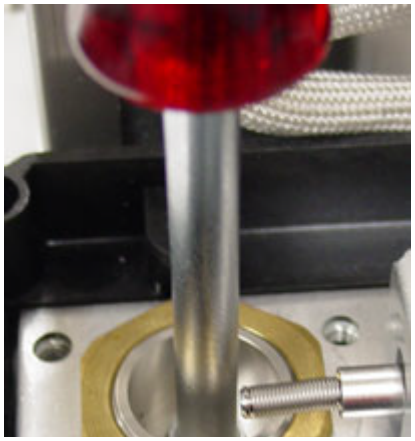


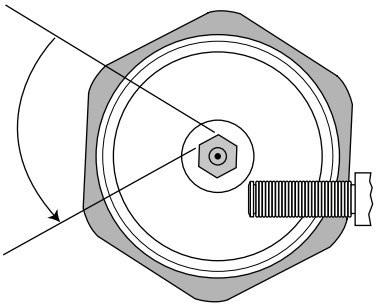
7 Clean the detector base cavity using solvent, a swab, and compressed air or nitrogen.

8 Use tweezers to lower the new jet into the housing.

CAUTION Do not overtighten the jet! Overtightening may permanently deform and damage the jet, the detector base, or both. The torque specification is 10 inch-pounds.

9 Carefully screw the jet into the housing. Tighten 1/6-turn past finger-tight (1/6-turn is one "flat" on a typical screwdriver handle, or the jet head).





10 Install the collector assembly. (See "To Replace the FID Collector Assembly" on page 98.)

11 Reset the jet counter.

12 Attach the capillary column to the detector.

- **a** Install the column in the detector. (See "To Install a Capillary Column in the FID" on page 95.)
- **b** After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
- **c** Check the FID leakage current. (See "To Check the FID Leakage Current" on page 112.)
- **d** Bakeout the detector. (See "To Bakeout the FID" on page 117.)
- **e** Restore the analytical method.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

- **f** Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

13 Check the FID baseline. (See "To Check the FID Baseline" on page 113.)

To Perform Maintenance on the FID Collector Assembly

NOTE Perform only the steps and gather only the parts that apply to the desired maintenance task(s).

1 Gather the following:

- Replacement ignitor assembly (See "Consumables and Parts for the FID" on page 86.)
- Replacement ignitor castle
- Two collector insulators
- Collector
- Spring washer
- Gasket
- T-20 Torx screwdriver
- 1/4-inch nut driver
- Tweezers
- 5/16-inch wrench
- Lint-free gloves
- Clean cloth

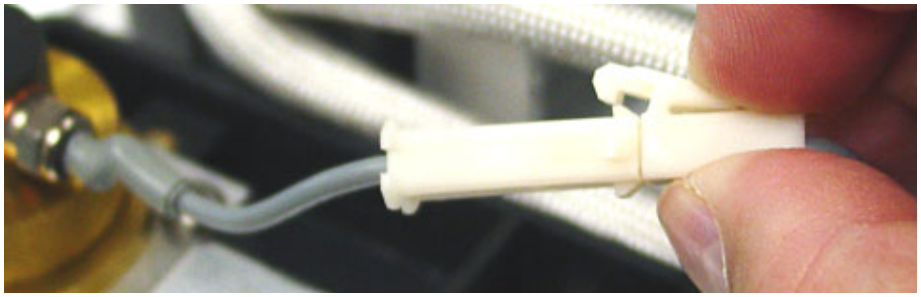
CAUTION To avoid contaminating the FID, wear clean, lint-free gloves when handling the collector assembly.

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

3 Remove the FID ignitor.

a Disconnect the ignitor cable assembly.

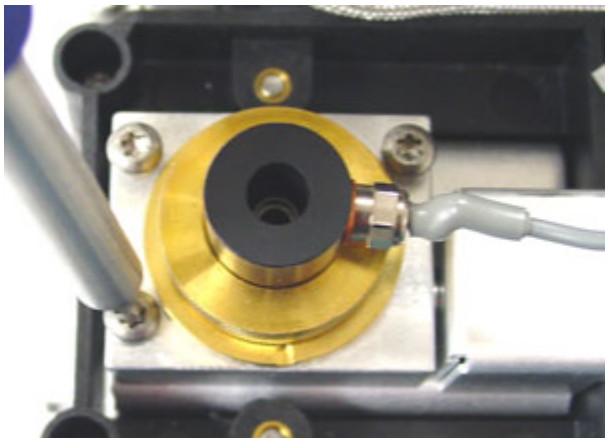


b Loosen the ignitor with a wrench.

c Turn the nut counterclockwise by hand. Remove the ignitor and copper washer.

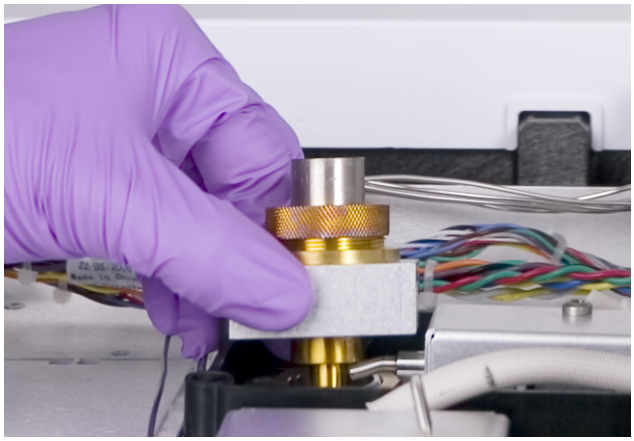
4 If replacing only the FID ignitor assembly with copper washer, skip to step 16 for assembly.

5 Remove the three screws that hold the collector mount to the FID thermal strap.



CAUTION This step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.

6 Remove the collector assembly. Place it on a clean cloth for additional disassembly.



7 Remove the gasket from the bottom of the assembly, if necessary.

8 Remove the FID ignitor castle.

a Loosen the collector nut.

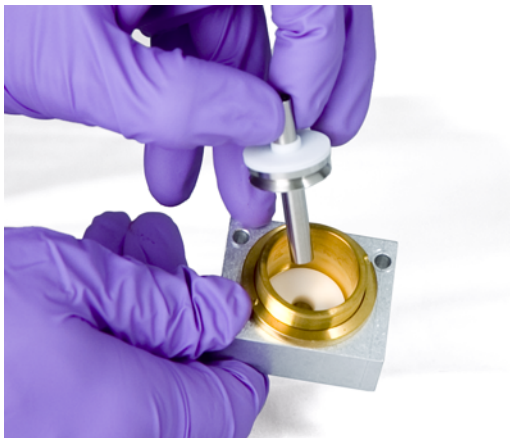
b Remove the collector nut and the spring washer.

c Lift the castle out of the collector housing. When removing the castle, some of the collector parts may be attached. Set these on a clean cloth to protect from scratches or dirt.

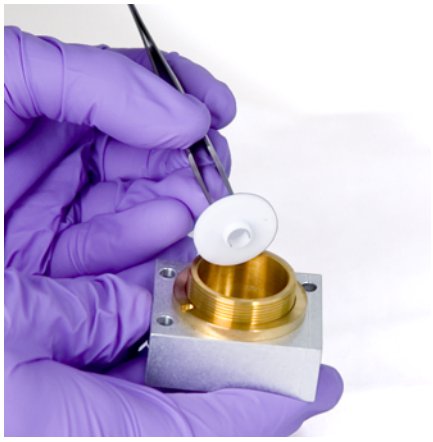
9 If only replacing the FID castle, skip to step 15 for reassembly.

10 Remove the collector and insulators.

a If needed, remove the collector and upper insulator from the FID housing. The lower insulator may come out with the collector, but often remains in the FID housing. Place the parts on a clean cloth.



b Remove the lower insulator with tweezers and place the parts on a clean cloth.

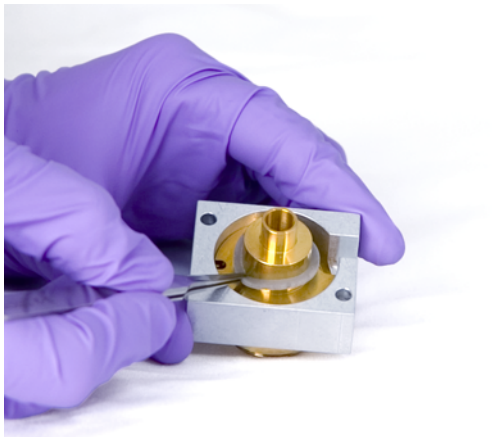


11 Remove the collector housing from the mount, if necessary.

12 Use tweezers to remove the gasket from the bottom of the housing.

The collector assembly is now completely disassembled. Reassemble as follows:

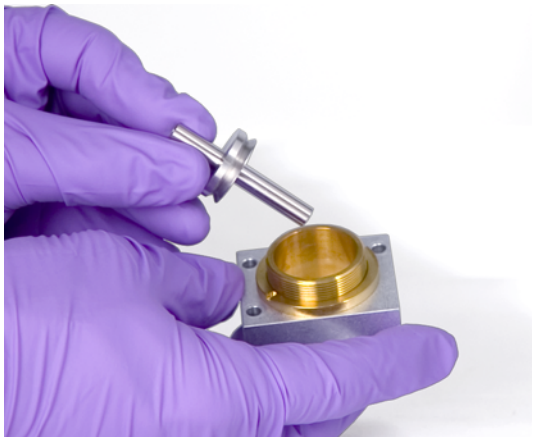
13 Use tweezers to install a new gasket onto the housing, being sure that it lays flat on the brass surface.



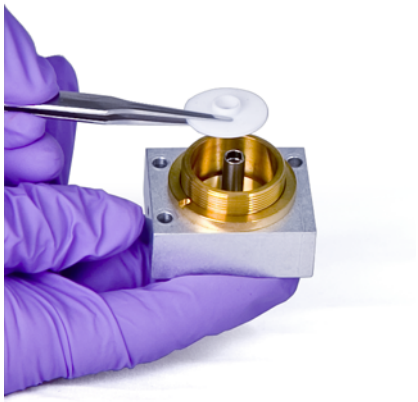
14 Install the collector insulators.

a Insert one of the insulators into the base of the housing. Seat the insulator with the flat surface facing out of the housing.

b Insert the long end of collector into the housing and lower insulator.



c Insert the other insulator onto the top of the collector, with the flat surface facing towards the housing.



15 Install the FID ignitor castle.

a Orient the castle so that the threaded hole for the ignitor faces toward the electronics.

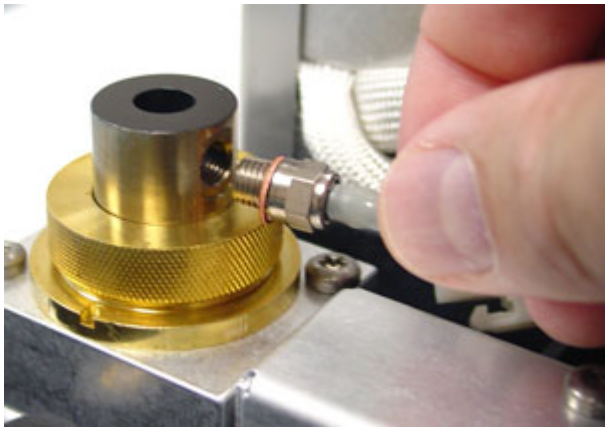
b Insert the FID castle into the collector housing.

c Install the spring washer over the castle.

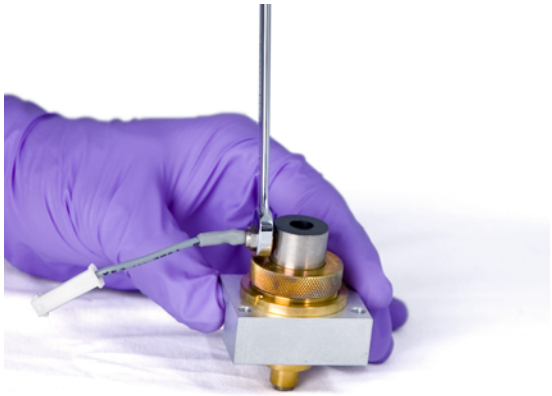
d Install the collector nut over the castle and tighten firmly. The seal should be airtight. Maintain the orientation of the ignitor hole with the base as shown below.

16 Install the FID ignitor.

a Insert the ignitor and copper seal into the threaded hole of the castle. Keep the mating threads clean.

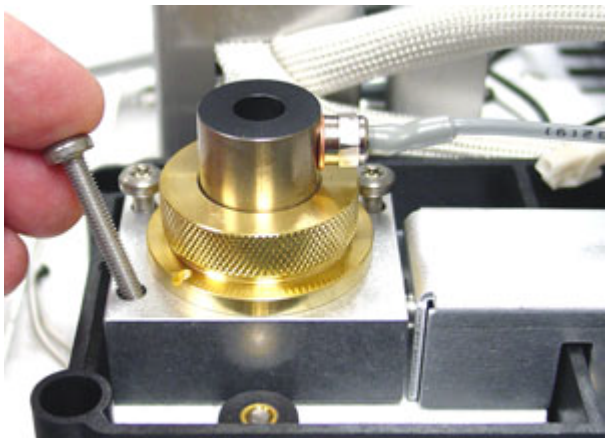


b Tighten the ignitor with a wrench. Ignition requires a good electrical contact that is free of any dirt.



17 Lower the collector assembly into the housing.

18 Insert the three screws and tighten (to 18 inch-pounds).



19 Connect the ignitor extension cable.

20 Verify assembly:

a Check the FID leakage current. (See "To Check the FID Leakage Current" on page 112.)

b Bakeout the detector. (See "To Bakeout the FID" on page 117.)

c Check the FID baseline. (See "To Check the FID Baseline" on page 113.)

To Check the FID Leakage Current

1 Load the analytical method.
   - Make sure flows are acceptable for ignition.
   - Heat the detector to operating temperature or 300 °C.

2 Turn off the FID flame.

3 Using the software keyboard, press **[Front Det]** or **[Back Det]**, then scroll to **Output**. Alternately, use the arrows keys on the GC to scroll to **Output**.

4 Verify that the output is stable and < 1.0 pA.

   If the output is unstable or > 1.0 pA, turn off the GC and check for proper assembly of the upper FID parts and contamination. If this contamination is confined to the detector, bakeout the FID. (See "To Bakeout the FID" on page 117.)

5 Turn on the flame.

To Check the FID Baseline

1 With the column installed, load your checkout method.

2 Set the oven temperature to 35 °C.

3 Using the software keyboard, press **[Front Det]** or **[Back Det]**, then scroll to **Output**. Alternately, use the arrows keys on the GC to scroll to **Output**.

4 When the flame is lit and the GC is ready, verify that the output is stable and < 20 pA.

If the output is not stable or > 20 pA, the system or gas may be contaminated. If this contamination is isolated to the detector, then bakeout the FID. (See "To Bakeout the FID" on page 117.)

To Install the FID Insulation Cup Assembly (Adaptable FID Only)

1 Gather the following:

- Insulation (See “Consumables and Parts for the FID” on page 86.)
- Insulation cup assembly

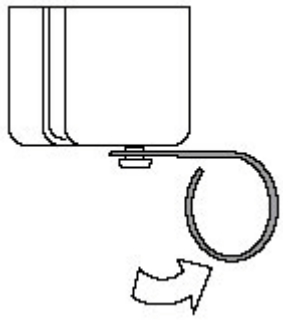
2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

3 Assemble the insulation in the cup. Line up the slots in the insulation with the slot in the cup.

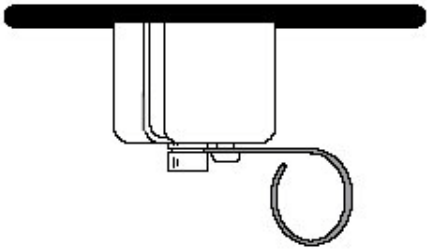
Capillary columns should be attached to the detector before installing the cup. When attaching a packed column to the detector, cap the detector fitting before installing the cup to prevent insulation contamination of the detector.

4 Push the wire spring lever to the right to uncover the hole.



5 From inside the oven with the column installed, pass the column through the slot in the cup. Move the cup up over the detector fitting so that the cup touches the top of the oven. You should be able to see the groove in the fitting.

6 Release the spring into the groove of the fitting.

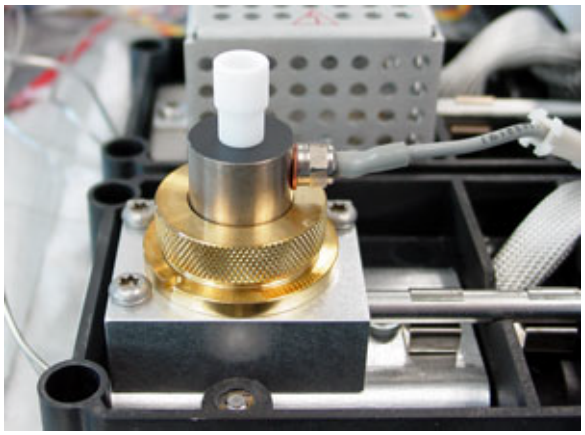


To Install the Optional FID PTFE Chimney Insert

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

1 Light the FID flame.

2 Insert the PTFE chimney into the FID castle.



NOTE When installed, the PTFE chimney insert prevents ignition.

To Bakeout the FID

WARNING **If using hydrogen as a carrier gas, turn off the hydrogen supply and cap the end of the column to prevent an oven explosion.**

1 Bakeout the FID with the column installed or uninstalled. If uninstalled, gather the following (see "Consumables and Parts for the FID" on page 86):

- Capillary adapter (adaptable FID only)
- Column nut
- No-hole ferrule

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

3 If the column is uninstalled, plug the detector connection with the capillary adapter, column nut, and no-hole ferrule.

   Maintain inert carrier gas flow through the column, or remove the column from the GC.

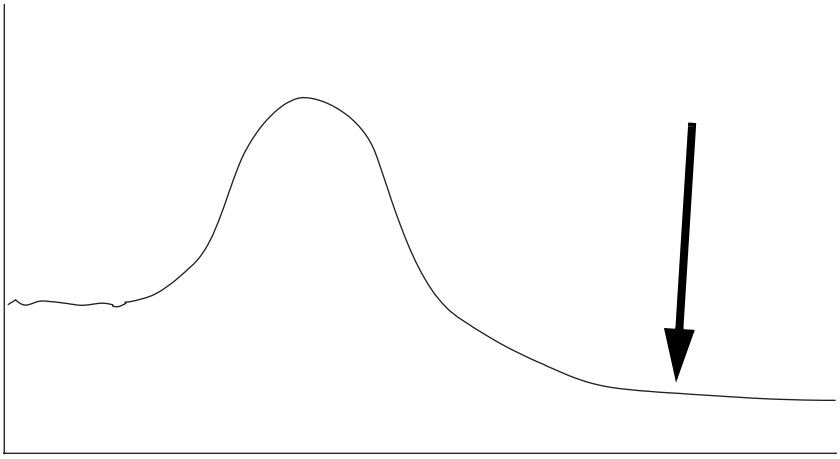
4 Set the detector temperature at 350 to 375 °C.

5 Set normal operating flows.

6 Light the FID flame.

7 Set the oven temperature to 250 °C or 25 °C above the normal maximum operating temperature. Do not exceed the column's temperature limit.

8 Hold at temperature for 30 minutes or until the baseline settles at a lower value. The baseline will typically rise, then fall to a final value lower than the initial baseline.



9 Restore the analytical method and allow the FID to equilibrate.

10 Check the FID output value. It should be lower than the first reading. If it is not, contact your Agilent service representative.

Without a column installed, a clean system baseline should be < 20 pA.

11 If the column is not installed in the FID, install it. (See "To Install a Capillary Column in the FID" on page 95.)

7
Maintaining the TCD

Consumables and Parts for the TCD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Standard TCD column hardware

Table 17 Standard parts for attaching columns to the TCD

Column	Description	Unit	Part number
Capillary	Nut, 1/8-inch id, brass Swagelok	10/pk	5180-4103
	Back ferrule, for 0.1-mm to 0.53-mm capillary columns	10/pk	5182-3477
	Front ferrule, 0.53-mm capillary columns	10/pk	5182-9673
	Front ferrule, 0.32-mm capillary columns	10/pk	5182-9676
	Front ferrule, 0.1-mm, 0.2-mm, and 0.25-mm capillary columns	10/pk	5182-9677
	1/8-inch Swagelok plug		5180-4124
1/4-inch packed	1/4-inch packed column adapter		G1532-20710
	1/8-inch id Vespel/graphite ferrule	10/pk	0100-1332
	Nut, 1/8-inch id, brass	10/pk	5180-4103
	Ferrule, Vespel, 1/4-inch	10/pk	5080-8774
	1/4-inch id tubing nut, brass	10/pk	5180-4105
	1/8-inch Swagelok plug		5180-4124
1/8-inch packed	Ferrule, 1/8-inch Vespel/graphite	10/pk	0100-1332
	Nut, 1/8-inch id, brass	10/pk	5180-4103
	1/8-inch Swagelok plug		5180-4124

Optional TCD capillary column hardware

Table 18 Optional TCD capillary column adapter hardware

Description	Unit	Part number
Capillary adapter		G1532-80540
Ferrule, Vespel, 1/8-inch	10/pk	0100-1332
Nut, brass, 1/8-inch	10/pk	5180-4103

Table 19 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

To Install a Capillary Column in the TCD

1 Gather the following:

- Front ferrule (See "Consumables and Parts for the TCD" on page 120.)
- Back ferrule
- Column nut
- Column cutter
- 7/16-inch wrench
- Lab tissue
- Lint-free gloves

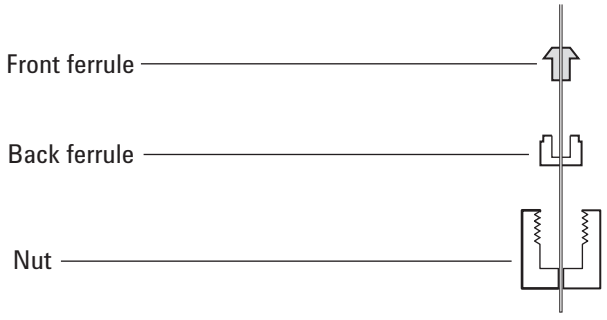
2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.**

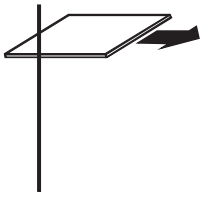
WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

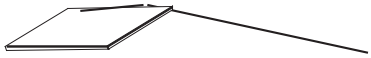
3 Assemble the ferrules and 1/8-inch brass Swagelok nut on the column.



4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.



5 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.



6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

7 Insert the column into the detector until it bottoms.

8 Slide the column nut and ferrules up the column to the detector and finger-tighten the nut.

9 Pull out 1 mm of column. Tighten the nut an additional 1/4 turn with a wrench or until the column does not move.

To Install the Optional TCD Capillary Column Adapter

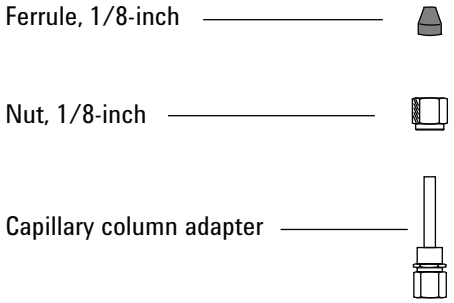
1 Gather the following:

- Capillary column adapter (See "Consumables and Parts for the TCD" on page 120.)
- 1/4-inch and 7/16-inch wrenches
- 1/8-inch brass nut
- 1/8-inch Vespel ferrule
- Lint-free gloves

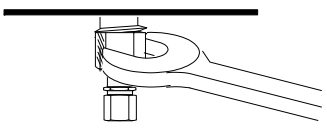
2 Load the GC maintenance method and wait for the GC to become ready.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble the brass nut and ferrule onto the capillary column adapter.



4 Install the adapter assembly into the detector fitting and tighten finger-tight. Use a wrench to tighten until snug.



To Install a Capillary Column with the Optional TCD Capillary Column Adapter

1 Gather the following:

- Ferrule (See "Consumables and Parts for the TCD" on page 120.)
- Column cutter
- Column nut
- 1/4-in. and 7/16-in. wrenches
- Lint-free gloves

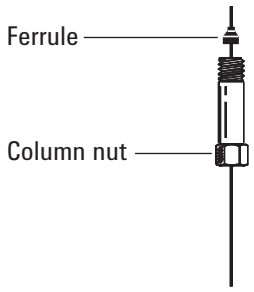
2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

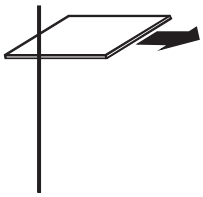
WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

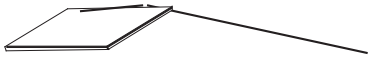
3 Place a capillary column nut and ferrule on the column.



4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

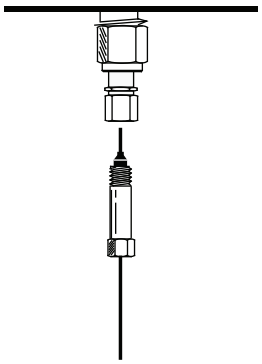


5 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

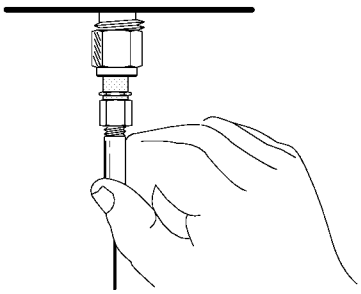


6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

7 Gently insert the column into the detector until it bottoms. Do not attempt to force it further.



8 Slide the column nut and ferrule up the column to the adapter and tighten the nut finger tight.



9 Pull the column out 1 mm. Use a wrench to tighten the nut an additional 1/4-turn. The column should not move.

To Bakeout Contaminants from the TCD

The bakeout can be performed with the column installed or the detector capped.

CAUTION If the column is not installed, you must turn off the TCD filament and cap the detector column fitting to prevent irreparable damage to the filament caused by oxygen entering the detector.

1 If the column is not installed, cap the detector.

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

2 Turn off the TCD filament.

3 If the column is attached to the inlet, maintain inert carrier gas flow through the column.

WARNING **If using hydrogen as a carrier gas, turn off the hydrogen supply and cap the end of the column to prevent an oven explosion.**

4 Set the reference gas flow rate between 20 and 30 mL/min.

5 Set the detector temperature to 375 °C.

6 Hold at 375 °C for several hours.

7 If the column is uninstalled, install it. (See "To Install a Capillary Column in the TCD" on page 122.)

8 Load the analytical method.

WARNING **Be careful! The oven or detector fittings may be hot enough to cause burns.**

9 Allow the oven, inlet, and detector to equilibrate at operating temperature, then re-tighten the fittings.

7 Maintaining the TCD

8
Maintaining the uECD

This section describes the routine maintenance tasks for the micro-Electron Capture Detector (uECD). For important regulatory and safety information for this detector, refer to the general information booklet and CD provided with the detector.

Important Safety Information About the uECD

The uECD contains a cell plated with ^{63}Ni, a radioactive isotope. The beta particles released at the energy level in the detector have little penetrating power—the surface layer of the skin or a few sheets of paper will stop most of them—but they may be hazardous if the isotope is ingested or inhaled. For this reason, handle the cell with care. Cap the detector inlet and outlet fittings when the detector is not in use. Never introduce corrosive chemicals into the detector. Vent detector exhaust outside the laboratory environment.

Refer to the safety documentation provided with the detector for important details about safety, maintenance, and compliance with local government regulation.

WARNING

Materials that may react with the ^{63}Ni source, either to form volatile products or to cause physical degradation of the plated film, must be avoided. These materials include oxidizing compounds, acids, wet halogens, wet nitric acid, ammonium hydroxide, hydrogen sulfide, PCBs, and carbon monoxide. This list is not exhaustive but indicates the kinds of compounds that may cause damage to ^{63}Ni detectors.

WARNING

In the extremely unlikely event that both the oven and the detector-heated zone should go into thermal runaway (maximum, uncontrolled heating in excess of 400 °C) at the same time and the detector remains exposed to this condition for more than 12 hours, take the following steps:

1. **After turning off the main power and allowing the instrument to cool, cap the detector inlet and exhaust vent openings. Wear disposable plastic gloves and observe normal laboratory safety precautions.**
2. **Return the cell for disposal, following directions included with the License Verification Form (part number 19233-90750).**
3. **Include a letter stating the condition of abuse.**

It is unlikely, even in this very unusual situation, that radioactive material will escape the cell. However, permanent damage to the ^{63}Ni plating within the cell is possible; therefore, the cell must be returned for exchange.

WARNING **Do not use solvents to clean the uECD.**

WARNING **You may not open the uECD cell unless authorized to do so by your local nuclear regulatory agency. Do not disturb the four socket-head bolts. These hold the cell halves together. United States customers removing or disturbing them is a violation of the terms of the exemption and could create a safety hazard.**

When handling uECDs:

- Never eat, drink, or smoke.
- Always wear safety glasses when working with or near open uECDs.
- Wear protective clothing such as laboratory jackets, safety glasses, and gloves, and follow good laboratory practices. Wash hands thoroughly with a mild nonabrasive cleaner after handling uECDs.
- Cap the inlet and outlet fittings when the uECD is not in use.
- Connect the uECD exhaust vent to a fume hood or vent it to the outside. See the latest revision of 10 CFR Part 20 (including Appendix B), or the applicable state regulation. For other countries, consult with the appropriate agency for equivalent requirements.

  Agilent Technologies recommends a vent line internal diameter of 6 mm (1/4-inch) or greater. With a line of this diameter, the length is not critical.

Consumables and Parts for the uECD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 20 uECD consumables and parts

Description	Part number/quantity
Fused silica indented mixing liner	G2397-20540
Makeup gas adapter	G3433-63000
ECD wipe test kit	18713-60050
Insulation	19234-60715 (3/pk)
Insulation cup assembly	19234-60700
Nut, 1/4-inch Swagelok adapter	5180-4105 (10/pk)
Ferrule, graphitized Vespel, 1/4-inch	5080-8774 (10/pk)
Capillary column blanking nut	5020-8294

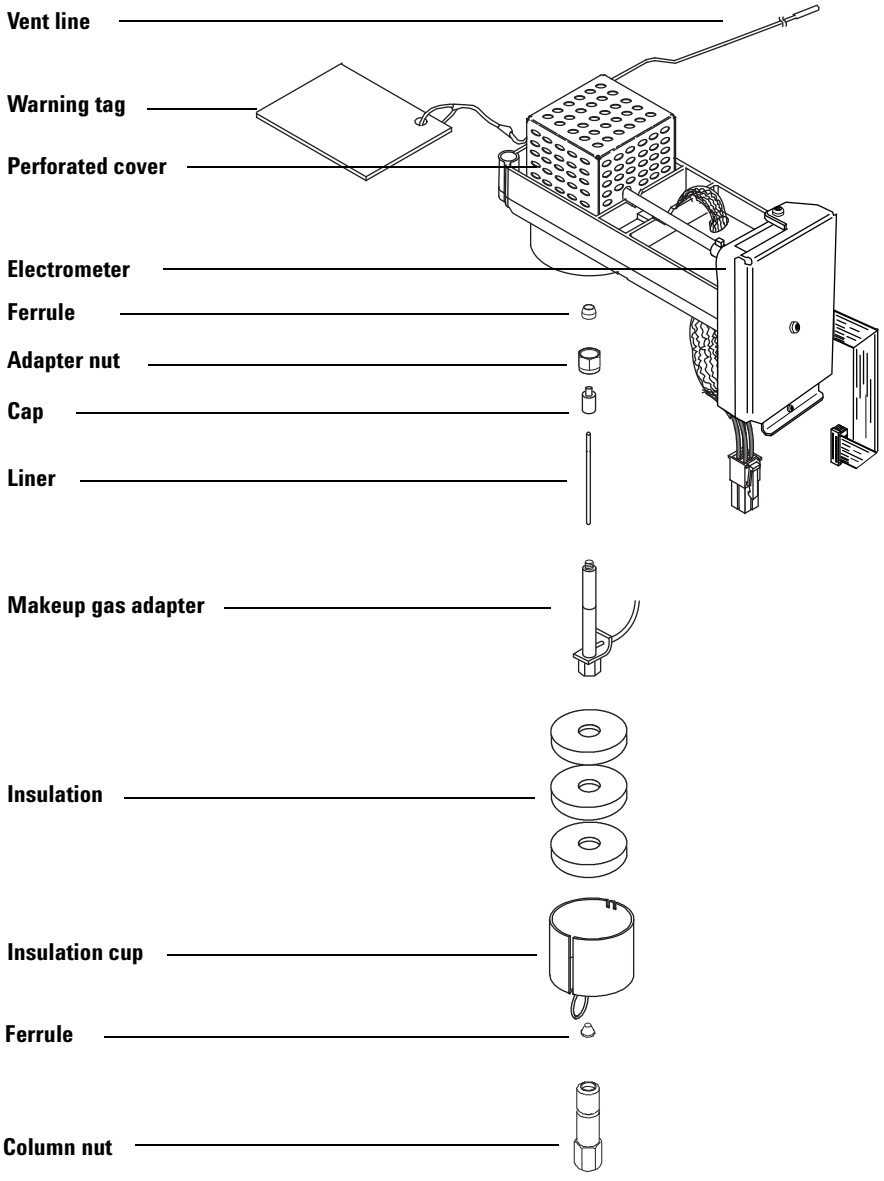
Table 21 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292

Table 21 Nuts, ferrules, and hardware for capillary columns (continued)

Column id (mm)	Description	Typical use	Part number/quantity
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

Exploded Parts View of the uECD



To Replace the uECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter

1 Gather the following:

- Fused silica indented mixing liner (See "Consumables and Parts for the uECD" on page 132.)
- 1/4-inch Swagelok nut
- 1/4-inch Vespel/graphite ferrule
- 9/16-inch wrench
- Methanol
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

3 Remove the insulating cup from the detector base.

4 Remove the column from the makeup gas adapter.

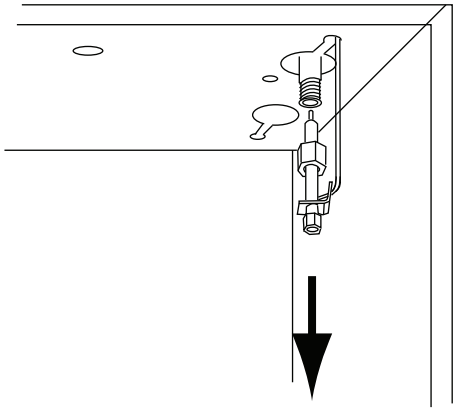
CAUTION To prevent damage avoid flexing/bending the tubing on the makeup gas adapter.

5 Remove the makeup gas adapter.

a Loosen the adapter nut with a wrench and slide out the makeup gas adapter from the uECD. Remove the ferrule.

The makeup gas adapter will remain attached to the supply tubing and hang suspended in the oven.

b Adjust the adapter's position so that maintenance can be performed on the adapter easily and without obstruction.



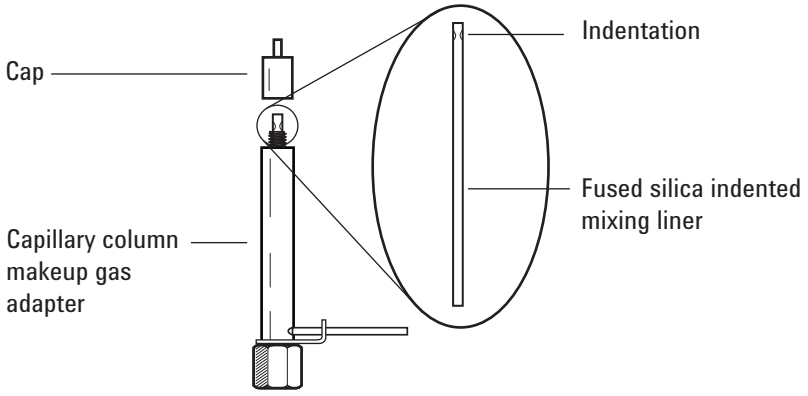
6 Unscrew and remove the adapter cap.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

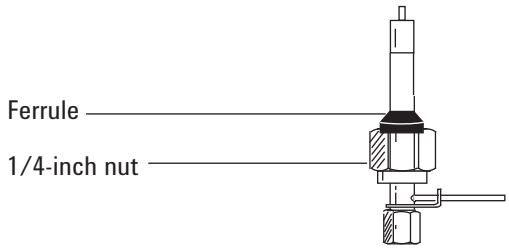
7 Remove the fused silica indented mixing liner and inspect. Replace it if it is broken or contaminated with sample or graphite.

8 Ultrasonically clean the adapter cap in methanol. Clean the outer surfaces of the makeup gas adapter with methanol.

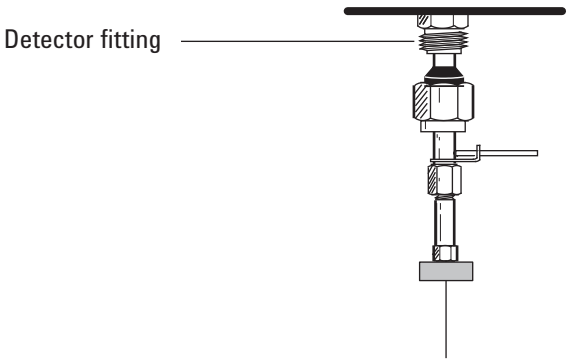
9 Install the fused silica indented mixing liner into the makeup gas adapter, then install the cap. The indentation on the fused silica indented mixing liner must be at the cap end of the adapter.



10 Place a new 1/4-inch Swagelok nut and ferrule onto the makeup gas adapter.

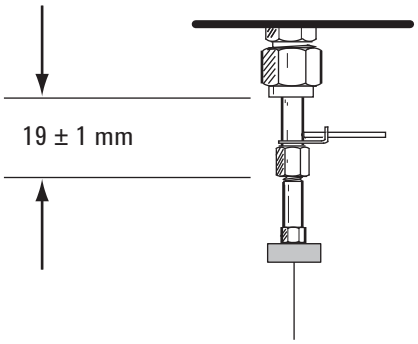


11 Slowly install the adapter straight into the detector fitting. Jiggle the adapter, if necessary, to make sure it is seated all the way into the detector fitting. Be careful not to break the column end.



12 Tighten the nut finger-tight and then use a 9/16-inch wrench to tighten until snug.

If the adapter is properly installed, the distance between the 1/4-inch nut and the bottom of the adapter will be 19 ± 1 mm. If the distance is 22 to 23 mm, install the adapter into the detector fitting.



13 Attach the column. (See "To Install a Capillary Column in the uECD" on page 139.)

To Install a Capillary Column in the uECD

1 Gather the following:

- Ferrule (See “Consumables and Parts for the uECD” on page 132.)
- Column nut
- Septum
- Column
- 1/4-inch, 5/16-inch, and 9/16-inch wrenches
- Column cutter
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

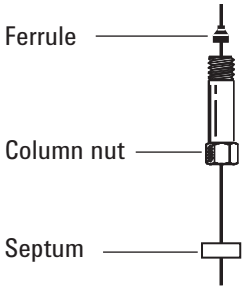
WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

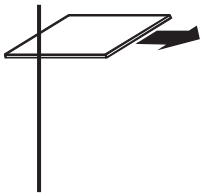
3 Load the inlet maintenance method and wait for the GC to become ready.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

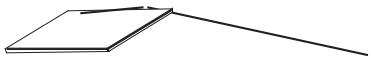
4 Place a septum (if the column id is ≤0.2 mm), capillary column nut, and ferrule on the column.



5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.



6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

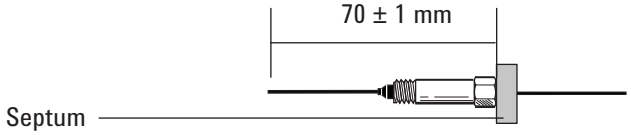


7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

8 Install the column.

If the column id is 200 um or more, push the column into the adapter until it stops at the indentation. Pull it back 1 to 2 mm and tighten the column nut with one 5/16-inch wrench on the adapter and another 1/4-inch wrench on the column nut.

If the id is less the 200 um, mark the column with a septum 70 ± 1 mm from the end. Insert column and nut into the adapter with the septum at the rear of the column nut, and tighten the column nut with one 5/16-inch wrench on the adapter and another 1/4-inch wrench on the column nut.



9 After heating the detector, retighten the 9/16-inch makeup adapter nut and 1/4-inch column nut.

To Install the Insulating Cup for the uECD

1 Gather the following:

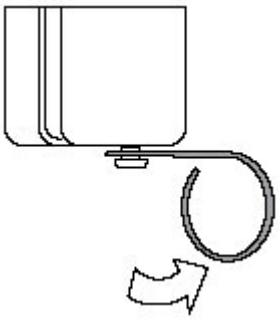
- Nut warmer insulation (See "Consumables and Parts for the uECD" on page 132.)
- Insulation cup assembly

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

3 Install the insulation in the cup. Line up the slots in the insulation with the slot in the cup.

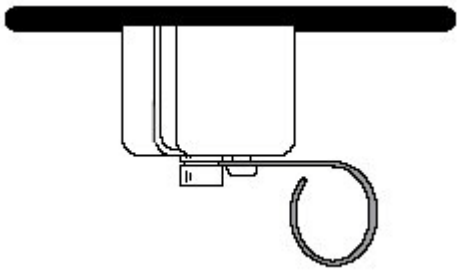
4 Push the wire spring lever to the right to uncover the hole.



5 With a capillary column installed to prevent insulation contamination of the detector, slide the column into the slot on the insulation cup and place the cup over the makeup gas adapter.

6 Slide the cup up so that the cup touches the top of the oven and you can see the groove in the makeup gas adapter.

7 Release the spring into the groove of the makeup gas adapter.



To Bakeout the uECD

WARNING **Detector disassembly and/or cleaning procedures other than thermal should be performed only by personnel trained and licensed appropriately to handle radioactive materials. Trace amounts of radioactive ^{63}Ni may be removed during other procedures, causing possible hazardous exposure to b- and x-radiation.**

CAUTION To prevent possible hazardous contamination of the area with radioactive material, the detector exhaust vent always must be connected to a fume hood or otherwise vented in compliance with the latest revision of 10 CFR Part 20, or with state regulations with which the Nuclear Regulatory Commission has entered into an agreement (USA only). For other countries, consult with the appropriate agency for equivalent requirements.

1 Gather the following:
   - Column nut and no-hole ferrule (See "Consumables and Parts for the uECD" on page 132.)
   - Blanking nut with any column ferrule

2 With the detector and oven at normal operating temperatures, show the detector output. Using the software keyboard, press **[Front Det]** or **[Back Det]**, then scroll to **Output**. Alternately, use the arrows keys on the GC to scroll **Output**. Note the value of **Output** for later comparison.

3 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

4 If the column maximum temperature is < 250 °C, remove the column from the detector.

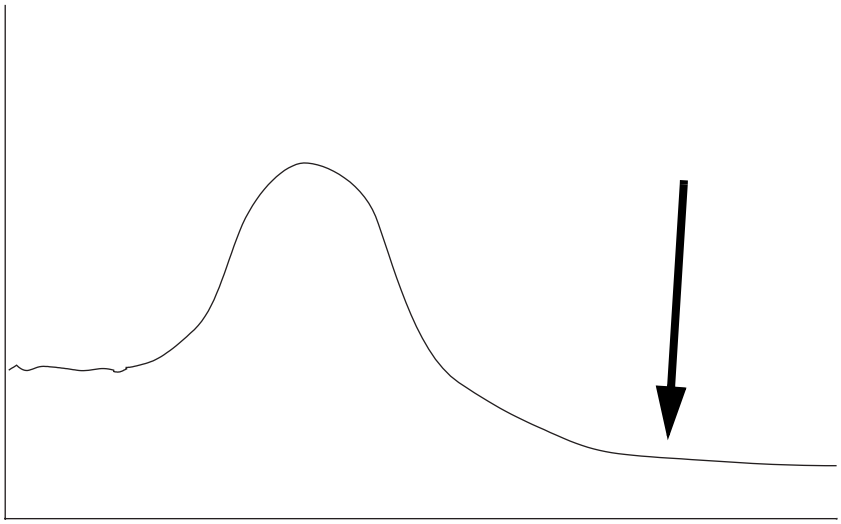
5 If the column is uninstalled, plug the detector connection with the column nut and no-hole ferrule.

Maintain inert carrier gas flow through the column, or remove the column from the GC.

6 Set the uECD temperature to 350 to 375 °C, the makeup gas flow to 60 mL/min, and the oven temperature to 250 °C. If the column is uninstalled, leave the oven off to protect the column.

7 If the column is installed in the uECD, set the oven temperature to 250 °C. If the column is uninstalled, leave the oven off to protect the column.

8 Allow thermal cleaning to continue for several hours and then cool the system to normal operating temperatures. The figure below shows detector output during a typical cleaning cycle.



9 Check the uECD output value on the control table. It should be lower than the first reading. If it is not, contact your Agilent service representative.

10 Reinstall the column.

11 Restore the analytical method.

8 Maintaining the uECD

9
Maintaining the NPD

Consumables and Parts for the NPD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Before selecting a jet, see "Selecting an NPD Jet" on page 152.

Table 22 NPD parts

Description	Part number/quantity
Collector	G1534-20530
Screw, M3 × 0.5 × 8 mm	0515-0655
NPD white ceramic bead assembly	G1534-60570
NPD black ceramic bead assembly	5183-2007
Screw, M4 × 10 mm	0515-2495
J-clamp	1400-0015
NPD ceramic insulator kit • Metal C-rings, top and bottom • Ceramic insulators, upper and lower	5182-9722
Insulation cup	19234-60720
NPD chemical sample kit solution of 0.65 ppm azobenzene, 1000 ppm octadecane, 1 ppm malathion in isooctane, 3 ampoules	18789-60060
NPD lid standoff	G1534-20590
Column adapters, for adaptable NPD only	
FID/NPD capillary column adapter	19244-80610
1/8-inch packed column adapter	19231-80520
1/4-inch packed column adapter	19231-80530
1/4-inch packed glass column adapter	G1532-20710
1/4-inch column nut	5180-4105 10/pk
1/4-inch Vespel/graphite ferrule	5080-8774 10/pk

Table 23 Jets for capillary optimized fittings

Jet type	Part number	Jet tip id	Length
Capillary with extended jet (recommended)	G1534-80580	0.29 mm (0.011 inch)	51.5 mm
Capillary	G1531-80560	0.29 mm (0.011 inch)	43 mm
High-temperature	G1531-80620	0.47 mm (0.018 inch)	43 mm

Table 24 Jets for adaptable fittings

Jet type	Part number	Jet tip id	Length
Capillary with extended jet (recommended)	G1534-80590	0.29 mm (0.11 inch)	70.5 mm
Capillary	19244-80560	0.29 mm (0.011 inch)	61.5 mm
Capillary, high-temperature	19244-80620	0.47 mm (0.018 inch)	61.5 mm
Packed	18710-20119	0.46 mm (0.018 inch)	63.6 mm

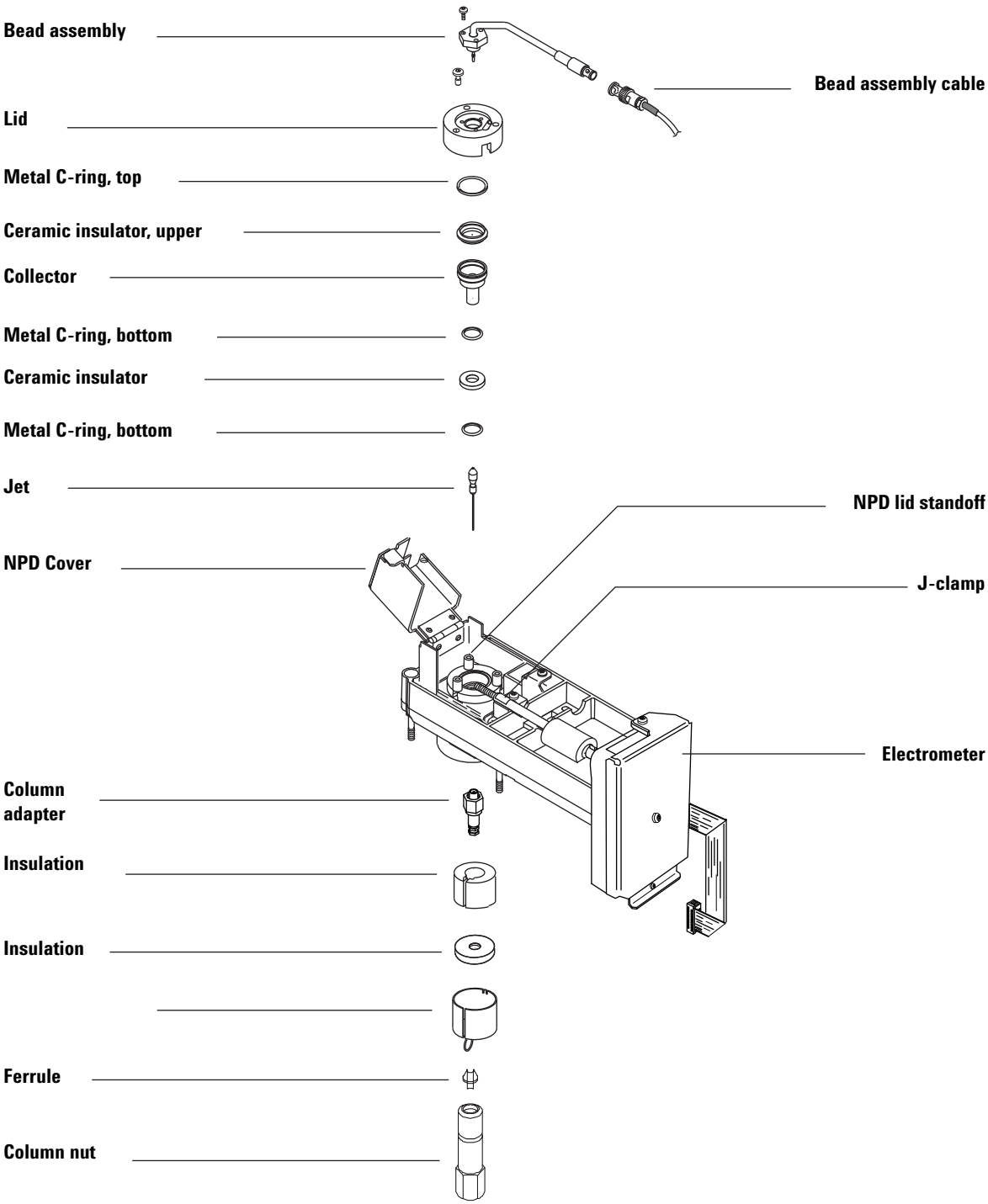
Table 25 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)

Table 25 Nuts, ferrules, and hardware for capillary columns (continued)

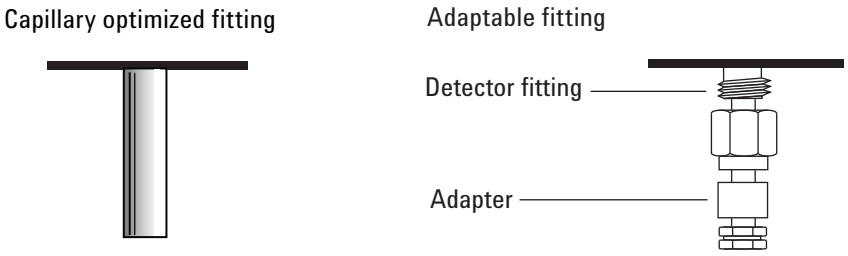
Column id (mm)	Description	Typical use	Part number/quantity
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

Exploded Parts View of the NPD



Selecting an NPD Jet

Open the oven door and locate the column connection fitting at the base of the detector. It will look like either a capillary optimized fitting or an adaptable fitting.



- If you have an application that tends to clog the jet, select a jet with a wider tip id.
- When using packed columns in high column-bleed applications, the jet tends to clog with silicon dioxide.

For capillary optimized fittings, select one of the following from Table 26.

Table 26 Jets for capillary optimized fittings

Figure 3 ID	Jet type	Part number	Jet tip id	Length
1	Capillary with extended jet (recommended)	G1534-80580	0.29 mm (0.011 inch)	51.5 mm
2	Capillary	G1531-80560	0.29 mm (0.011 inch)	43 mm
3	High-temperature	G1531-80620	0.47 mm (0.018 inch)	43 mm

Figure 3 Capillary optimized NPD jets

For adaptable fittings, select one of the following from Table 27.

Table 27 Jets for adaptable fittings

Figure 4 ID	Jet type	Part number	Jet tip id	Length
1	Capillary with extended jet (recommended)	G1534-80590	0.29 mm (0.11 inch)	70.5 mm
2	Capillary	19244-80560	0.29 mm (0.011 inch)	61.5 mm
3	Capillary, high-temperature	19244-80620	0.47 mm (0.018 inch)	61.5 mm
4	Packed	18710-20119	0.46 mm (0.018 inch)	63.6 mm

Figure 4 Adaptable NPD jets

To Attach a Capillary Column Adapter on an Adaptable NPD

1 Gather the following materials:

- Adapter (See “Consumables and Parts for the NPD” on page 148.)
- 1/4-inch nut
- 1/4-inch ferrule
- Column cutter
- 1/4-inch wrench
- 9/16-inch open-end wrench
- Lint-free gloves

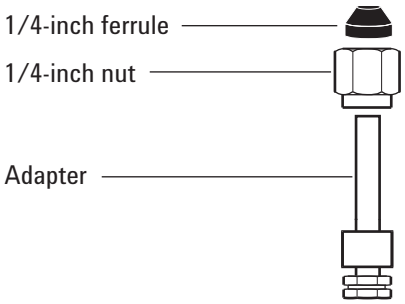
2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

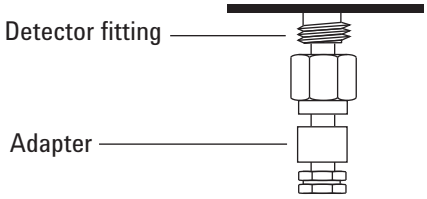
3 Assemble a brass nut and Vespel/graphite ferrule onto the adapter.



4 Insert the adapter straight into the detector base as far as possible.

5 Hold the adapter in this position and finger-tighten the nut.

Adaptable fitting



6 Tighten an additional 1/4 turn with a wrench.

To Install a Capillary Column in the NPD

1 Gather the following materials:

- Column
- Ferrule(s) (See "Consumables and Parts for the NPD" on page 148.)
- Column nut
- Column cutter
- 1/4-inch open-end wrench
- Septum
- Isopropanol
- Lab tissue
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

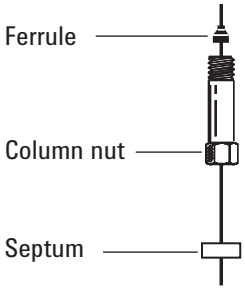
WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

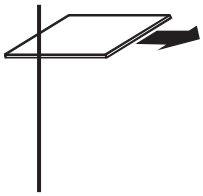
If using the adaptable detector, verify that the adapter is installed. (See "To Attach a Capillary Column Adapter on an Adaptable NPD" on page 154.)

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

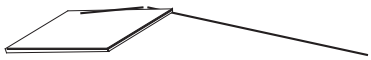
3 Place a septum (if the column id is ≤0.1 mm), capillary column nut, and ferrule on the column.



4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.



5 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.



6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

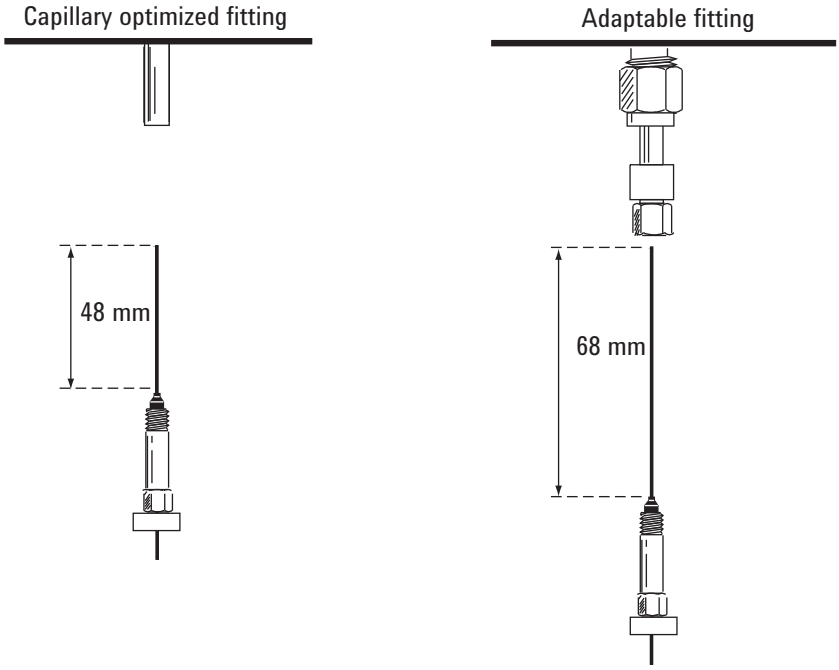
7 Install the capillary column.

If the column id is greater than 0.1 mm:

a Gently insert the column into the detector until it bottoms; do not attempt to force it further.

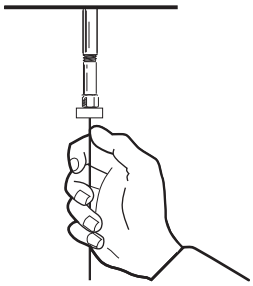
b Finger-tighten the column nut, then withdraw the column about 1 mm. Tighten the nut an additional 1/4 turn with a wrench.

If the column id is 0.1 mm or less position the column so it extends above the ferrule by 48 mm (*capillary optimized* fitting) or 68 mm (*adaptable* fitting). Slide the septum up to hold the column nut and ferrule at this fixed position.



c Insert the column into the detector. Slide the nut and ferrule up the column to the detector base. Finger-tighten the column nut until it grips the column.

d Adjust the column (*not* the septum) position so that the septum is even with the bottom of the column nut. Tighten the nut an additional 1/4 turn with a wrench.



To Replace the NPD Bead Assembly

1 Gather the following:

- Replacement NPD bead assembly. (See "Consumables and Parts for the NPD" on page 148.)
- Lint-free gloves
- T-10 Torx screwdriver

CAUTION The bead is delicate. Be careful not to break or crack the bead. When performing maintenance on the NPD, avoid touching the bead with your fingers, and prevent it from coming in contact with other surfaces.

2 Using the Software Keypad or data system, set the NPD bead voltage to **0.0**, then turn it off. (Setting the bead voltage to zero first makes sure that when you turn the bead back on, the voltage is safe. Otherwise, turning off the bead voltage will save a high setpoint that can damage a new bead.)

Agilent data system users: After setting the bead voltage to 0.0, save the data system method and shut down the instrument session.

3 Set **Adjust Offset** to **Off**.

4 Cool the detector to 60 °C or lower. Leave all gas flows on. To cool the detector faster, raise the GC detector cover and open the hinged NPD cover.

5 Remove the GC detector top cover.

WARNING **Hazardous voltages are present when the electronics top cover is open.**

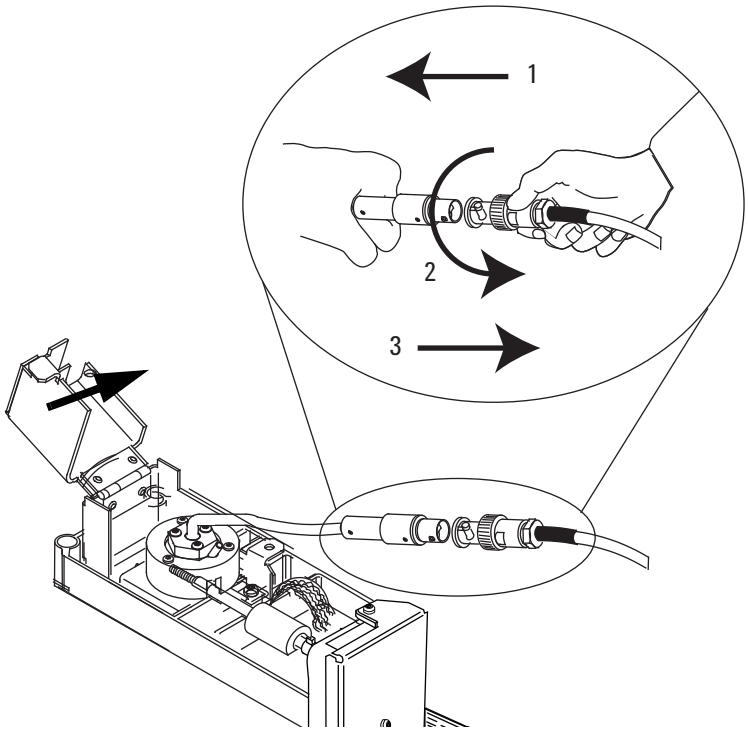
6 Remove the electronics cover. See "To Remove the Electronics Cover".

7 Put on lint-free gloves before touching any of the detector parts.

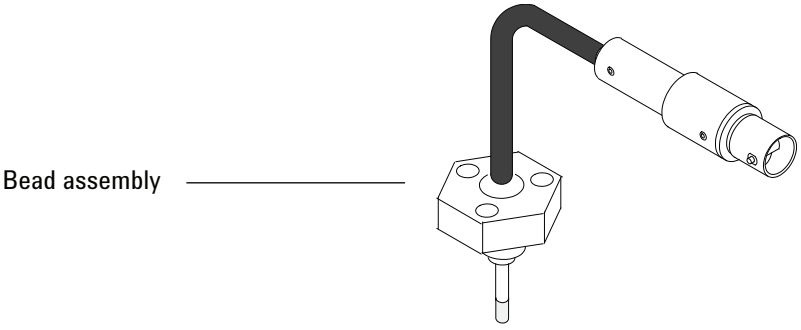
WARNING **Be careful! The oven or detector fittings may be hot enough to cause burns.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

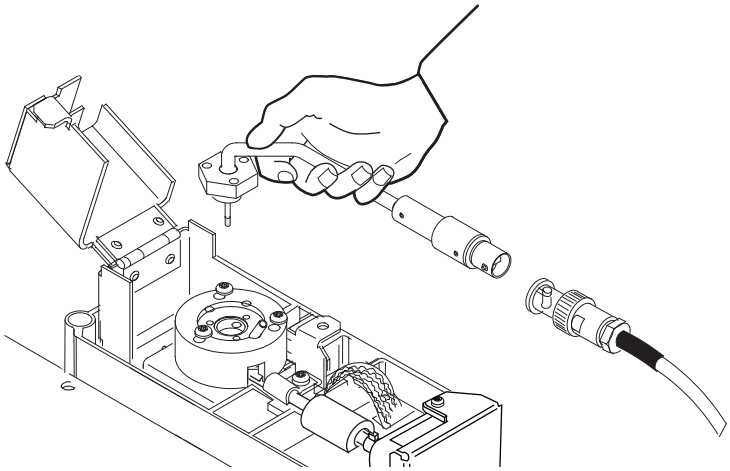
8 Twist the ring to disconnect the bead assembly cable. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart.



9 Remove the 3 T-10 Torx screws from the bead assembly.



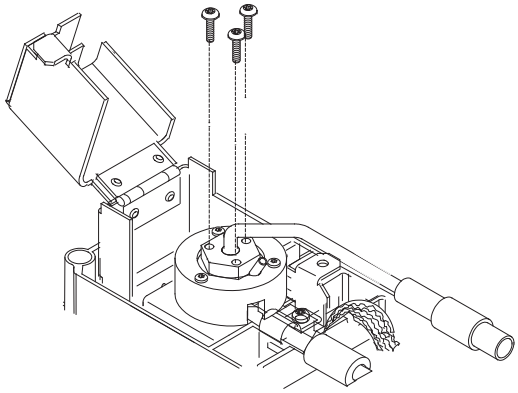
10 Gently lift up and remove the old bead assembly. Avoid bumping the bead on the sides of the collector.



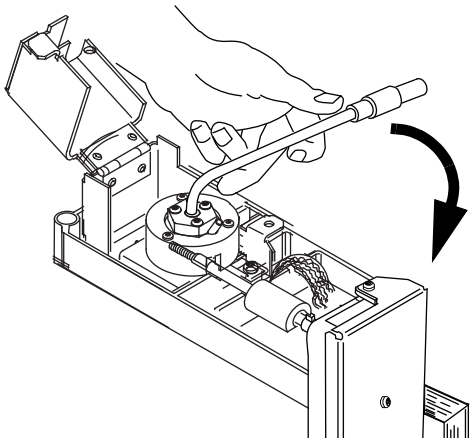
11 Remove the protective cap covering the new bead.

12 Mount the new bead assembly on the NPD lid. Be careful not to bump the bead on the sides of the lid or collector.

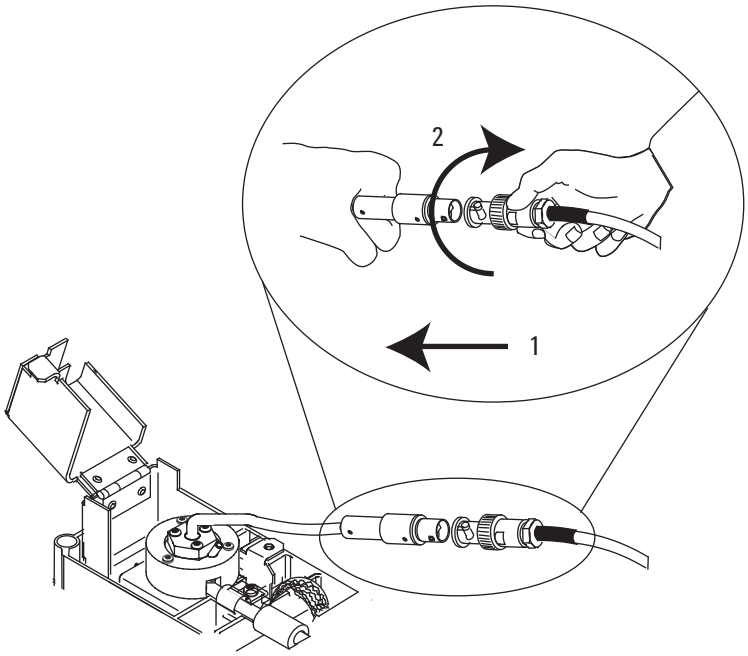
13 Replace the screws. Finger-tighten the first screw; tighten the remaining screws normally and then completely tighten the first screw. Do not overtighten the screws.



14 Carefully bend the bead assembly cable 90 °.



15 Reconnect the bead assembly cable to the NPD cable and twist the ring to lock the connection.



16 Close the NPD cover, install the GC detector top cover, and install the electronics top cover. All covers must be closed to get a stable NPD baseline.

17 Configure the new bead.

- Set the bead type.
- Review the **Maximum Bead Voltage** setting and adjust, if necessary.
- Review the **Dry Bead** and **Auto Adjust Bead** settings.

18 Restore normal NPD operating gas flows.

19 With all gases on, heat the detector to 150 °C and hold for about 15 minutes, then increase the temperature to 250 °C and hold for 15 minutes.

20 Increase the temperature to operating value (310 to 320 °C recommended). Allow 15 minutes for equilibration.

21 Check the NPD leakage current. (See "To Check the NPD Leakage Current" on page 170.) If > 2.0 pA, verify bead installation or see the Troubleshooting manual.

22 If using an Agilent data system, connect to the instrument.

23 Restore the analytical method. Confirm the detector hydrogen, air, makeup gas flow rates.

24 Set equilibration time to **0.0**. Start the **Adjust offset** process. Enter the desired offset in the **Target offset** field. The default offset is 30 pA for white or black beads. For white and black beads, an offset of 25 to 30 pA is sufficient for most applications. The bead life may be shortened at a higher offset.

25 Reset the bead counter.

To Maintain the NPD Collector, Ceramic Insulators, and Jet

When replacing the jet, always install a new collector, ceramic insulators, and metal C-rings.

When replacing the collector, Agilent recommends replacing the ceramic insulators and metal C-rings.

1 Gather the following:

- NPD ceramic insulator kit (see "Consumables and Parts for the NPD" on page 148.)
- Collector
- Cap for the bead
- T-10 and T-20 Torx screwdrivers
- Tweezers
- Cotton swab
- Solvent
- Methanol
- Jet (see "Selecting an NPD Jet" on page 152)
- Lint-free gloves
- Compressed, filtered dry air or nitrogen

CAUTION The bead is delicate. Be careful not to break or crack the bead. When performing maintenance on the NPD, avoid touching the bead with your fingers, and prevent it from coming in contact with other surfaces.

2 Set the bead voltage to **0.0** and **Adjust Offset** to **Off**.

3 Check and note the NPD leakage current for reference. (See "To Check the NPD Leakage Current" on page 170.)

4 Load the GC maintenance method and wait for the GC to become ready.

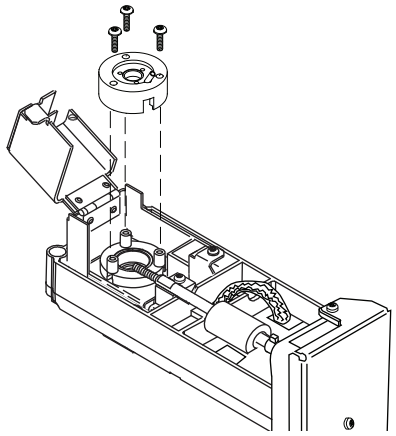
WARNING **Be careful! The oven or detector fittings may be hot enough to cause burns.**

5 Remove the bead. (See "To Replace the NPD Bead Assembly" on page 159.)

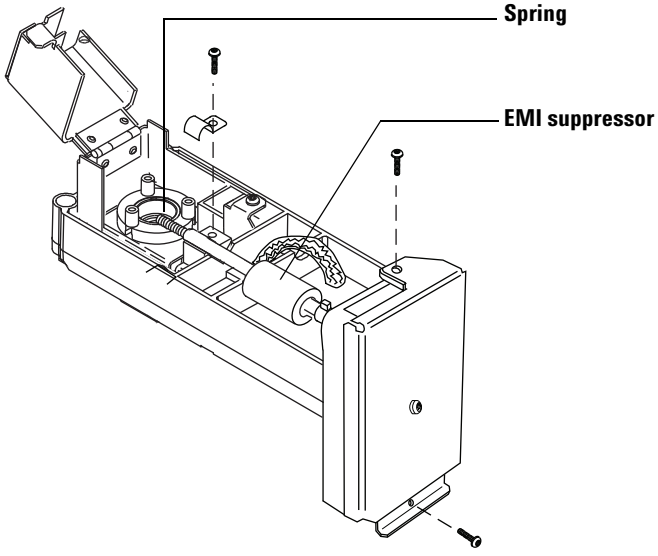
CAUTION This step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

6 Remove the screws that secure the lid, and remove it. The top metal C-ring and upper ceramic insulator may be attached to the lid.



7 Remove the screws that secure the electrometer and the interconnect.



8 Pull the electrometer away from the detector to free the interconnect. Turn the electrometer to the right to obtain working space. Be careful not to touch or bend the spring. Be careful not to lose the EMI suppressor.

9 Remove the large metal C-ring and the upper ceramic insulator if they were not attached to the lid.

10 Remove the collector. If the detector is operated at high temperatures, the collector parts may stick inside the detector. Gently push and wiggle them to break the seal.

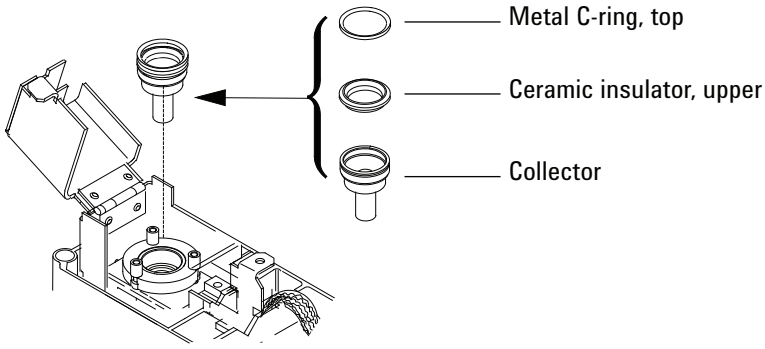


Figure 5 NPD collector, upper insulator, and metal C-ring

11 Use tweezers to remove the lower ceramic insulator and the two small metal C-rings located above and below the collector. If these parts are stuck together, do not separate them. If they are not stuck, remember which metal ring was on top of the insulator and which was below it. The pieces must be reassembled in the same orientation.

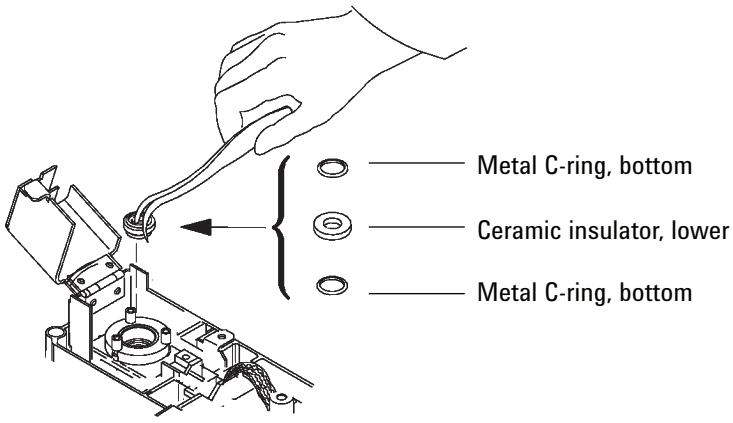
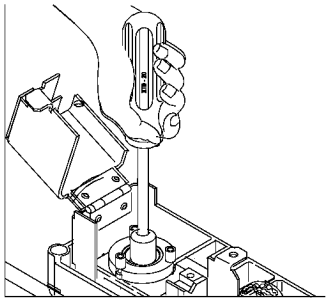


Figure 6 NPD lower ceramic insulator and metal C-rings

12 If not replacing the jet, skip to step 19.

13 Remove the column from the detector.

14 Loosen the jet with a nut driver.



15 Pull the jet straight out of the detector. Use tweezers, if necessary.

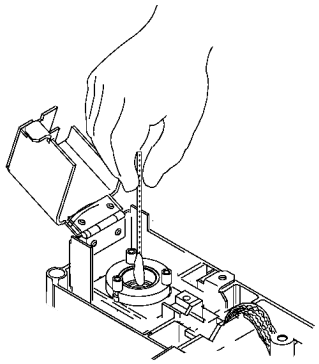
CAUTION The adaptable NPD jet is longer than the capillary optimized NPD extended jet and should never be installed in a capillary optimized detector.

16 Place the jet in the detector body.

17 Using a nut driver, tighten the jet 1/6 turn past finger-tight. *Do not overtighten.*

18 Attach the column to the detector. (See "To Attach a Capillary Column Adapter on an Adaptable NPD" on page 154.)

19 Use a cotton swab wetted with solvent to clean the residue from the inside of the collector and around the jet. If the collector appears very dirty, replace it with a new one.

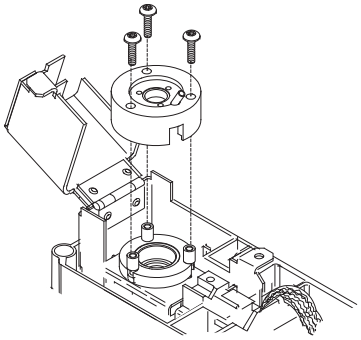


20 Install the bottom metal C-ring, the lower ceramic insulator, and the top metal C-ring. See Figure 5.

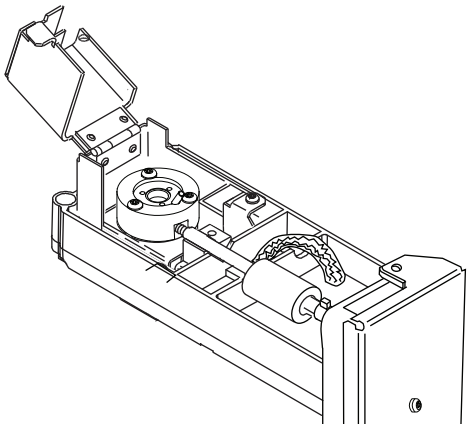
21 Install the collector.

22 Install the upper ceramic insulator and top metal C-ring above the collector. See Figure 6.

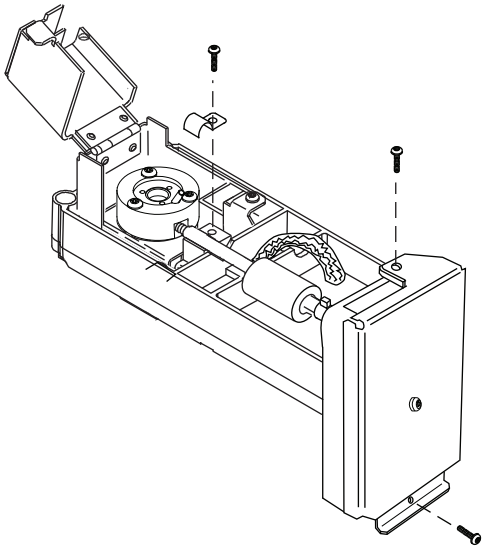
23 Install the lid, making sure that the NPD lid standoffs are in their slots. Hold the lid flat while each of the screws is tightened until they touch the lid. Tighten each screw evenly, 1/2 turn at a time, until tight. Do not overtighten.



24 Slide the electrometer interconnect into the slot on the lid and lower the electrometer into the mounting tray. Be careful not to touch or bend the spring.



25 Install the J-clamp and screws to secure the electrometer to the pallet.



26 Install the bead assembly and restore normal operating conditions. (See "To Replace the NPD Bead Assembly" on page 159.) (Do not reset the bead counter unless replaced.)

After installing new collector parts, the NPD leakage current should be lower. (See "To Check the NPD Leakage Current" on page 170.) If the leakage current is abnormal, check for proper reassembly of the detector (especially where the electrometer interconnect contacts the collector assembly) and for leaks.

To Check the NPD Leakage Current

1 Load the analytical method.

2 Set the **NPD Adjust Offset** to **Off** and the **Bead Voltage** to **0.00 V**.

- Leave the NPD at operating temperature
- Leave flows on or off

3 Using the software keyboard, press **[Front Det]** or **[Back Det]**, then scroll to **Output**. Alternately, use the arrows keys on the GC to scroll to **Output**.

4 Verify that the output (leakage current) is stable and < 2.0 pA.

The output should slowly drop towards 0.0 pA, and should stabilize in the *tenths* of a picoamp. Current > 2.0pA indicates a problem.

10
Maintaining the FPD

Consumables and Parts for the FPD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 28 FPD supplies

Description	Part number/quantity
Sulfur filter	1000-1437
Sulfur filter spacer	19256-20910
Phosphorus filter	19256-80010
Exit tube assembly, aluminum	19256-60700
Exit tube assembly, stainless steel	19256-20705
Vespel ferrule, 1/4-inch id	0100-1061
Ignitor replacement kit • O-ring • Spacer • Glow plug	19256-60800
Screw, M3 × 66 mm, T-10	0515-0680
Collar	19256-20690
Capillary adapter nut	19256-21150
Capillary adapter seat	19256-21140
1/4-inch packed adapter	G1532-20710
Column measuring tool	19256-80640
Spring to secure photomultiplier tube	1460-1160
1/8-inch packed adapter nut	0100-0057
1/8-inch Vespel ferrule for packed adapter	0100-1332

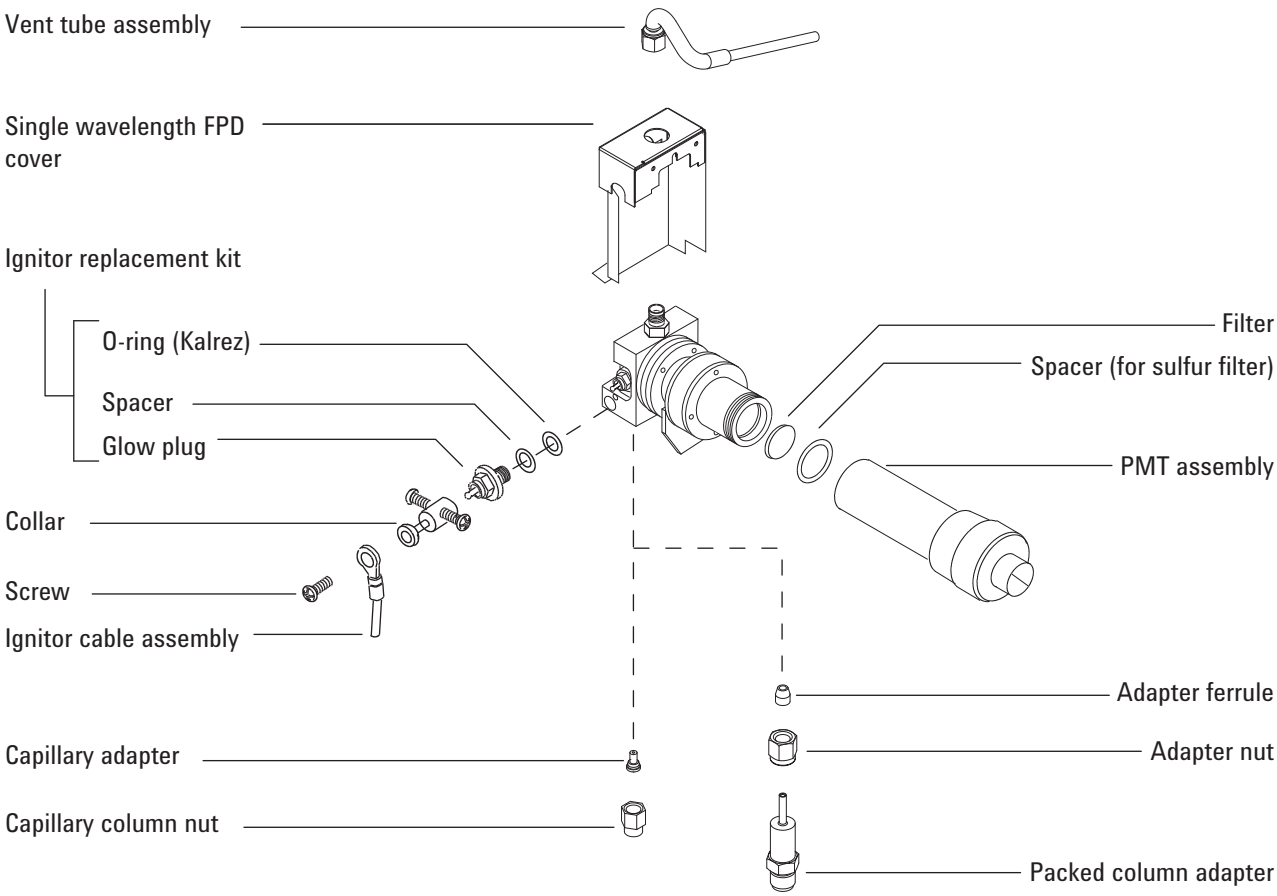
Table 29 Nuts, ferrules, and hardware for capillary columns

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293

Table 29 Nuts, ferrules, and hardware for capillary columns (continued)

Column id (mm)	Description	Typical use	Part number/quantity
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing–use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)

Exploded Parts View of the FPD



To Install a Capillary Column Adapter in the FPD

1 Gather the following:

- FPD capillary column adapter (See "Consumables and Parts for the FPD" on page 172.)
- Column cutter
- 1/4-inch wrench
- 9/16-inch wrench
- Metric ruler
- 1/8-inch nut
- Lint-free gloves

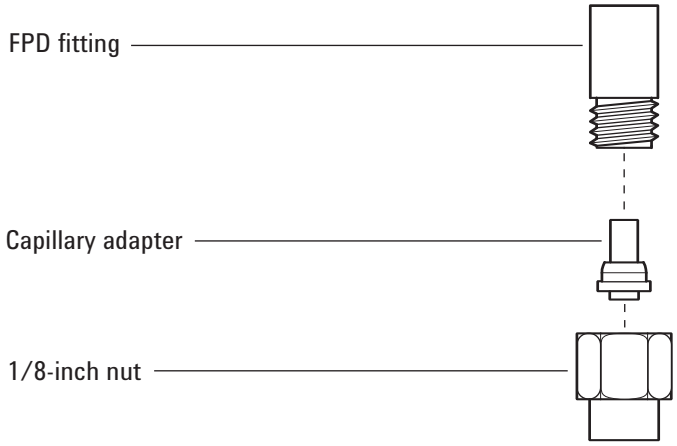
2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Insert the capillary adapter into the 1/8-inch nut as shown, then thread the nut onto the detector fitting.



4 Finger-tighten the nut, then tighten an additional 1/8 turn with a wrench.

To Attach a Capillary Column to the FPD

1 Gather the following:

- Column measuring tool (See "Consumables and Parts for the FPD" on page 172.)
- Column cutter
- 1/4-inch and 7/16-inch wrenches
- Column nut
- Ferrule
- Capillary column
- Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

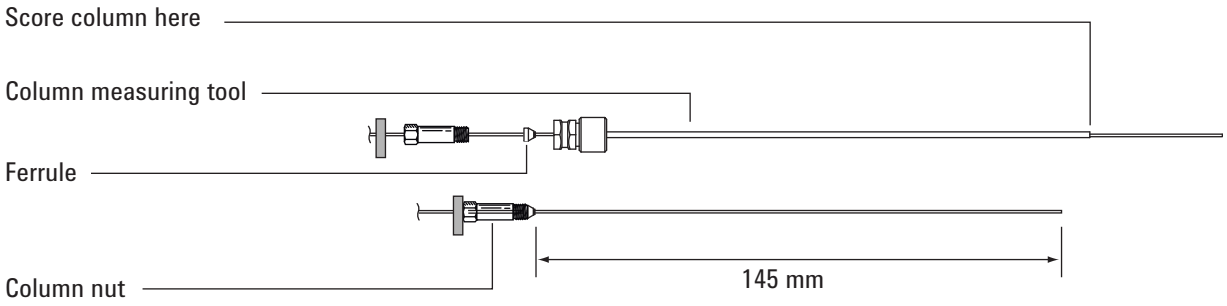
WARNING **Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.**

WARNING **Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.**

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble a septum, column nut, and ferrule on the end of the column.

4 Insert the end of the column through the column measuring tool so that the end protrudes beyond the tool.



5 Tighten the column nut until it grips the column. Tighten the nut an additional 1/8 to 1/4 turn with a pair of wrenches. Snug the septum against the base of the column nut.

6 Use a wafer cutter at 45° to score the column.

7 Snap off the column end. The column may protrude about 1 mm beyond the end of the tool. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.

8 Remove the column, nut, and swaged ferrule from the tool.

9 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

10 Verify that a capillary adapter is installed in the detector fitting. (See "To Install a Capillary Column Adapter in the FPD" on page 175.)

11 Carefully thread the swaged column up into the adapter. Finger-tighten the column nut, then use a wrench to tighten an additional 1/8 turn.

To Change the FPD Wavelength Filter

CAUTION Do not touch the filter with your bare hands. For optimum performance and to avoid scratches, use lint-free gloves for assembling and inserting the filter into the assembly.

1 Gather the following:
   - Sulfur filter with filter spacer (See "Consumables and Parts for the FPD" on page 172.)
   - Phosphorus filter
   - Cotton swab
   - Lens tissue
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

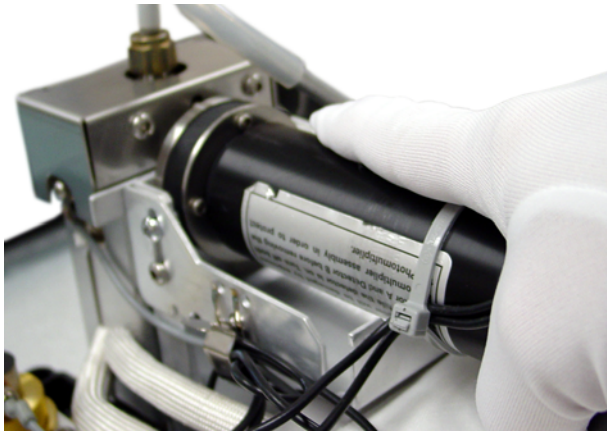
3 Turn off the photomultiplier tube (PMT).
   a Select **[Front Det]** or **[Back Det]**.
   b Scroll to **PMT voltage**.
   c Press **Off**.

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

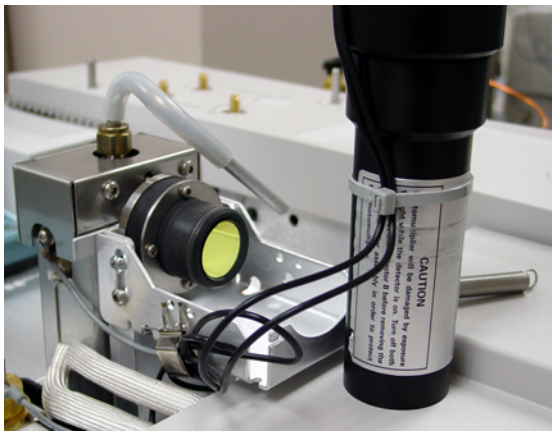
CAUTION The photomultiplier tube (PMT) is extremely sensitive to light. Always turn off the electrometer (which turns off the high voltage to the PMT) before removing the PMT housing or opening the emissions chamber. Failing to do this can destroy the PMT.

Even with the electrometer off, protect the PMT from room light. Cap the housing after it is removed, place it end down to exclude light, or reduce the room light level before exposing the PMT. A brief exposure (always with the electrometer turned off) will not damage it, but prolonged exposure will cause a gradual loss of sensitivity.

4 Disconnect the retaining spring that holds the PMT assembly to the bracket. With a rotating motion, pull the assembly away from the filter housing.

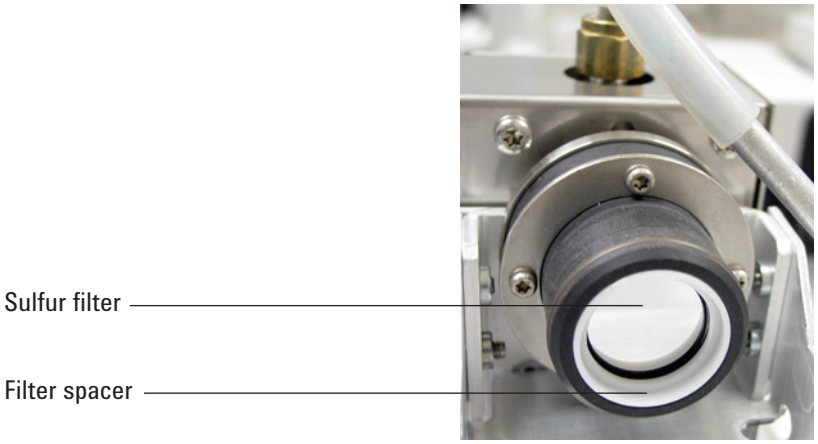


5 To prevent light from damaging the PMT, cap the end or place it face down.



6 Place a clean cloth under the filter housing to catch the filter.

- For phosphorus filter, use the sharpened wooden tip of a toothpick or cotton swab to dislodge the filter from the housing.
- For sulfur filter (shown below), use the wooden tip of the cotton swab to remove the filter spacer. Then dislodge the filter from the housing.



CAUTION Do not use cleaning fluids. Cleaning fluids will damage lens coatings.

7 Clean the new filter with lens tissue.

CAUTION Filters are designed for the light of the flame to pass through in a specific direction. The triangle (on the edge of the phosphorus filter) and the arrow (on the edge of the sulfur filter) should face *away* from the flame and *toward* the PMT.

8 Install the filter in the filter housing. Install the sulfur filter spacer, if necessary.

9 Replace the PMT assembly and secure with the spring.

10 Restore the analytical method.

To Remove the FPD Vent Tube

1 Gather the following:
   - T-20 Torx screwdriver
   - 9/16-inch wrench

2 Load the GC maintenance method and wait for the GC to become ready.

CAUTION When turning off the GC, first turn off the flame to prevent condensation from dripping into the jet and column.

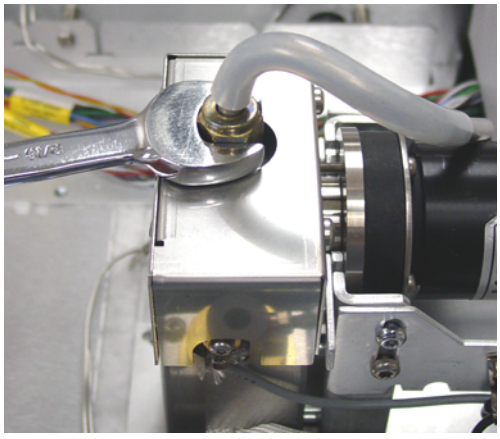
WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

3 Drain any water from the flexible vent tubing and discard.

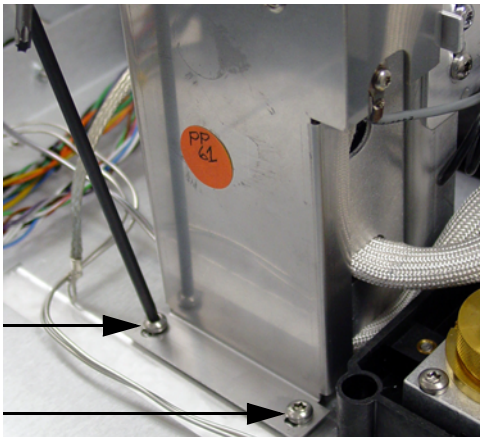
4 Open the FPD cover.

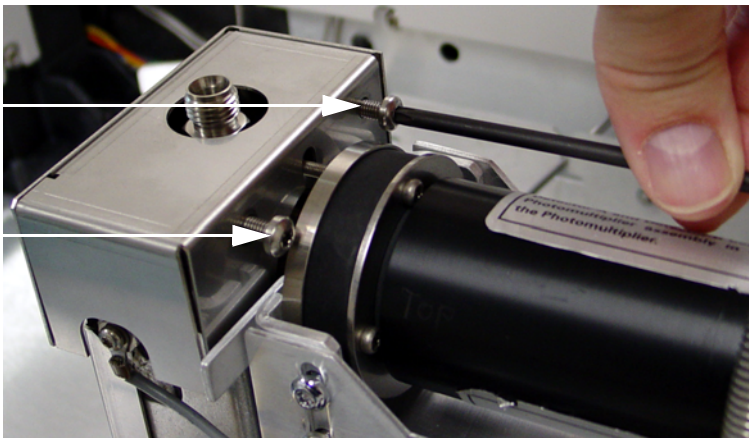
5 Remove the flexible tubing from the FPD vent tube.

6 Loosen and remove the vent tube assembly with a wrench.



7 Remove the screws securing the FPD cover.
   - The single-wavelength detector has two screws at the bottom of the left side (top photo below) and two screws at the top of the right side (bottom photo below).





8 Lift the cover off the detector.

To Replace the FPD Ignitor

1 Gather the following:

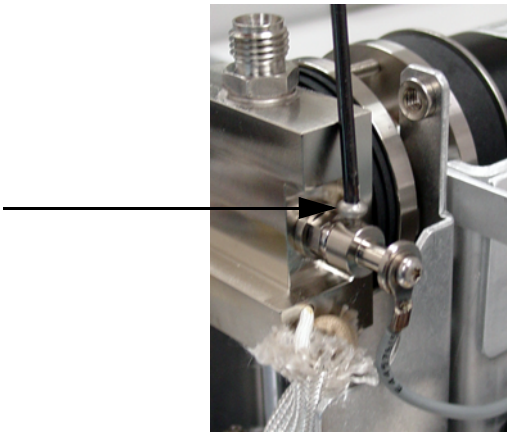
- Ignitor replacement kit. (See "Consumables and Parts for the FPD" on page 172.)
- Torx screwdrivers, T-20 and T-10
- 9/16-inch wrench
- Tweezers

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

3 Remove the vent tube assembly and cover. (See "To Remove the FPD Vent Tube" on page 182.)

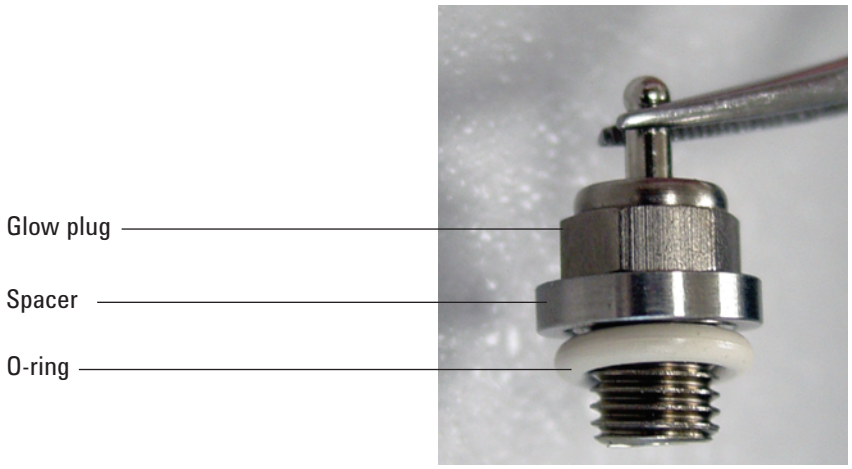
4 Loosen the collar screw (some have two screws) holding the cable assembly to the ignitor. Remove the collar and cable assembly.



5 Use a wrench to loosen and remove the glow plug.

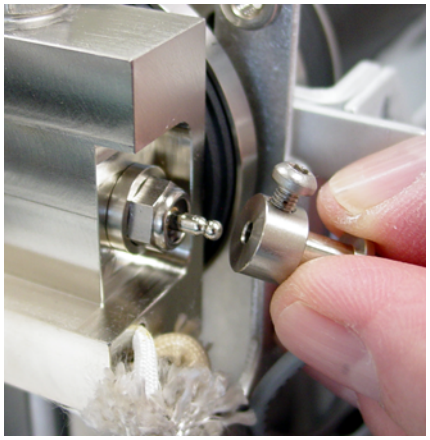
6 Remove the O-ring with tweezers.

7 Assemble the parts for the new ignitor.



8 Install the new ignitor assembly and tighten with a wrench. Do not overtighten.

9 Replace the ignitor collar and cable assembly and tighten the screw.



10 Replace the cover and the vent tube assembly. (See "To Install the FPD Vent Tube and Cover" on page 186.)

11 Restore the analytical method.

12 Wait 20 minutes for the detector to heat up, then ignite the flame.

To Install the FPD Vent Tube and Cover

1 Gather the following:
   - T-20 Torx screwdriver
   - 9/16-inch wrench

2 Install the cover.

   Single-wavelength detector:

   a Start the two screws on the right side of the cover.

   b Start and tighten the screws at the base on the left side.

   c Tighten the screws on the right side.

3 Install the vent tube assembly.

4 Reconnect the flexible tubing to the vent tube assembly and route the open end to waste.

5 Close the FPD cover.

11
Maintaining the PCM

Consumables and Parts for the PCM

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 30 PCM consumables

Description	Part number
O-rings, package of 12	5180-4181
Proportional valve, Carrier	G3430-67013

Calibrating the PCM Interface

The interface's flow module contains a pressure sensor that must be zeroed after it is installed on the GC. Calibration ensures an accurate interface pressure display.

Do not connect the carrier gas to the flow module until you have zeroed the interface's pressure sensor. For more information on zeroing the pressure sensor, refer to the Advanced User Guide. Use the Software Keyboard to complete the following steps.

1. If the gas supply is connected to the GC, turn off the supply at the source, then disconnect the supply line from the PCM inlet fitting.
2. Turn on the GC and wait 15 minutes to allow it to reach thermal equilibrium.
3. When the GC has reached thermal equilibrium, press **[Options]**, scroll to Calibration and press **[Enter]**.
4. Scroll to the module to be zeroed and press **[Enter]**.
5. Scroll to a zero line and press **[Info]**. The GC will remind you of the conditions necessary for zeroing that specific sensor.

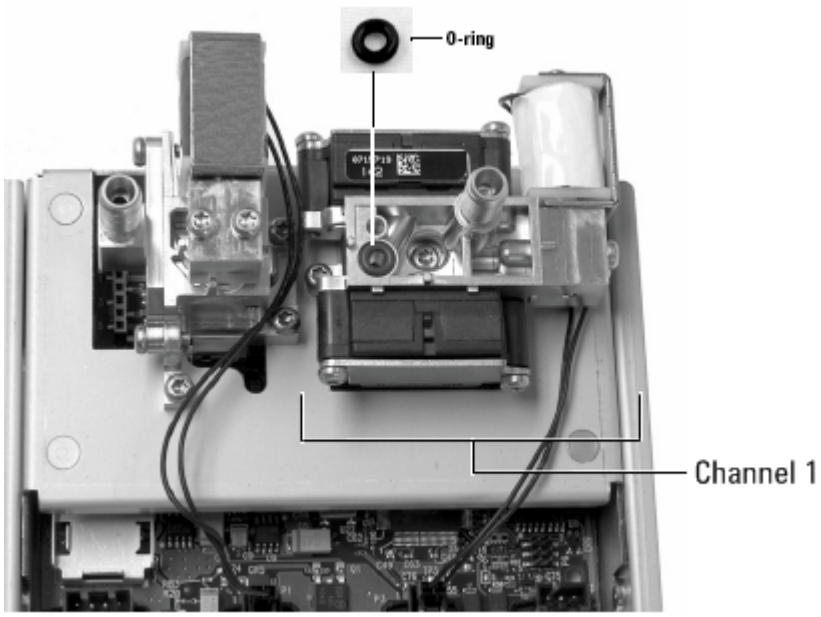
   Flow sensors. Verify that the gas is connected and flowing (turned on).
6. Press **[On/Yes]** to zero or **[Clear]** to cancel.
7. Turn off the GC.
8. Plumb the carrier gas to the flow module.
9. Turn on the GC.

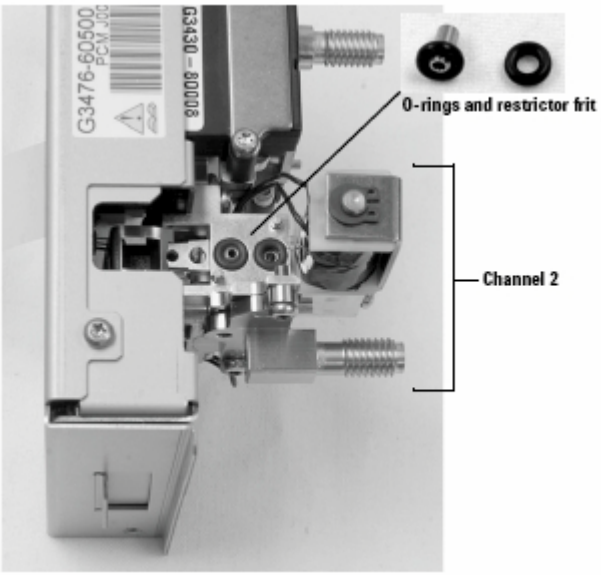
If you were calibrating the flow sensor after replacing the PCM, check for leaks.

Installing or Replacing Frits in the PCM

To install or replace a frit:

1. Gather the following:
   - O-rings, package of 12, 5180-4181
   - Restrictor
   - Tweezers
2. Turn off the gas supply to the channel.
3. Select the appropriate frit. For information on selecting PCM channel frits, refer to the Advanced User Guide.
4. Remove the screw holding the tubing block with the output tubing.
5. Remove the tubing block. Remove the frit and O-ring using the tweezers. Be careful to avoid scratching the metal surfaces.
6. Remove the other O-ring as well. Replace it with a new O-ring.





7 Place a new O-ring on the new frit and press it down into the block.

8 Place the block on the module and tighten the screw firmly.

9 Restore the gas supply.

WARNING **When hydrogen is used, dangerously high flows are possible if insufficient flow resistance is provided downstream of the supply tube. Always use either the High (Blue dot) or Medium (Red dot) frit with hydrogen.**

After installing or replacing a frit, be sure to update the PIDs used with your PCM. For more information, refer to the Advanced User Guide.

11 Maintaining the PCM

12
Maintaining a Valve

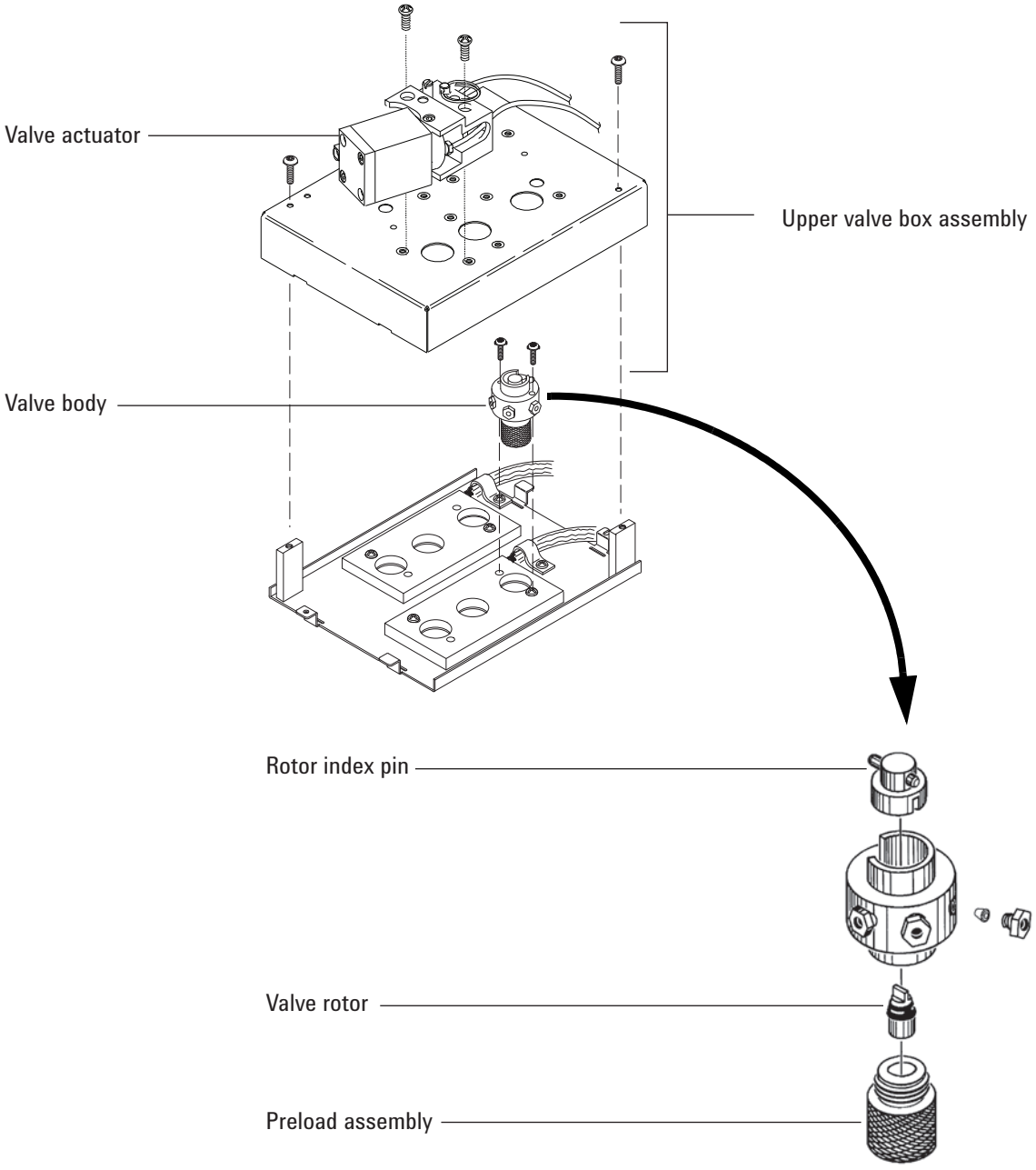
Consumables and Parts for Valves

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (**www.agilent.com/chem/supplies**).

Table 31 Valve supplies

Description	Part number
Valves, gas sampling	
6-port, 300 psi	0101-0584
6-port, 400 psi, 225 °C maximum temperature	5062-9508
6-port, 300 °C maximum temperature	0101-0460
6-port Hastelloy, 400 psi, 225 °C maximum temperature	5062-9509
10-port, 400 psi, 225 °C maximum temperature	5062-9510
10-port Nitronic 60, 300 psi, 350 °C maximum temperature	0101-0585
10-port Hastelloy, 400 psi, 225 °C maximum temperature	5062-9511
Gas sampling valve sample loops	
0.25-cc	0101-0303
0.50-cc	0101-0282
1.00-cc	0101-0299
2.00-cc	0101-0300
2.0-mL nickel loop, 1/16-inch	0101-0955
5.00-cc	0101-0301
10.00-cc	0101-0302
Ferrule, 1/16 inch stainless steel (10/pk)	5181-1291
Nut, 1/16 inch (10/pk)	5181-1292

Exploded Parts View of GC Rotary Valves



To Replace a Gas Sampling Valve Loop

1 Gather the following:
   - Replacement sample loop. (See "Consumables and Parts for Valves" on page 194.)
   - 1/4-inch wrench
   - Vacuum cleaner

2 Load the GC maintenance method and wait for the GC to become ready.

3 Turn off the detector.

WARNING

The oven, inlet, detector, and valve box may be very hot.

Sample and/or harmful gases may be present. Refer to your company's standard operating procedures for purging the chemicals from the sample line.

4 Set all valve box valves to **Off**.

5 Leave on the GC and valve actuator air.

6 Turn off the carrier gas and sample line flows and relieve any back pressure to the valve.

WARNING

The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

1. Ventilate your work area

2. Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator

3. Dispose of insulation in a sealed plastic bag

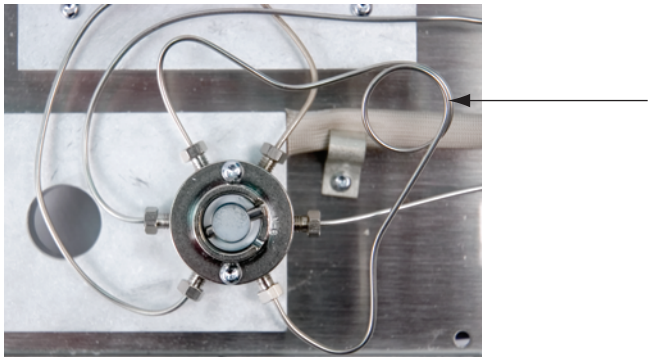
4. Vacuum any residual particles and discard

5. Wash your hands with mild soap and cold water after handling RCFs.

7 Remove the upper valve box. (See "To Remove the Upper Valve Box" on page 202.)

8 Vacuum any loose particulate insulation.

9 When the valve is cool, loosen the sample loop's two 1/4-inch fittings on the valve head and remove the loop.



10 Install the new sample loop.

11 Repressurize the sample loop and check for leaks.

12 Install the upper valve box. (See "To Install the Upper Valve Box" on page 204.)

13 Restore the analytical method.

To Align a Rotary Valve Rotor

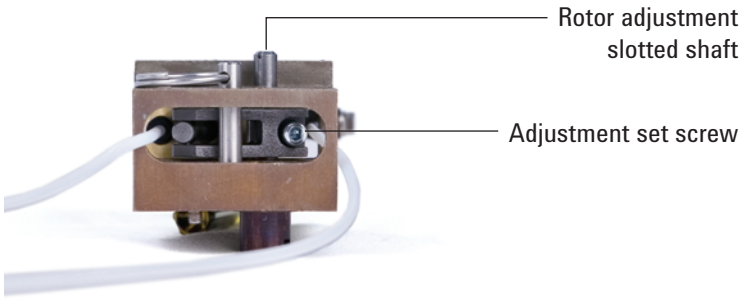
1 Gather the following:
   - Flathead screwdriver
   - 3-mm hex key wrench
   - T-20 Torx screwdriver

2 Set the oven and valve box heated zones to a safe handling temperature (25 °C).

3 Set all valves to **Off**.

WARNING **The oven, inlet, detector, and valve box may be very hot. If they are hot, wear heat-resistant gloves to protect your hands.**

4 Loosen the adjustment set screw.



5 Locate the rotor adjustment shaft on top of the actuator. Using a flathead screwdriver, rotate the valve rotor counterclockwise until it stops, then back it off a small amount to set one end of the rotor's motion (< 1 mm).

6 Tighten the adjustment set screw.

7 Turn the valve **On**, turn **Off** to check for smooth operation.

8 Restore the analytical method.

To Replace a Rotary Valve in the Valve Box

WARNING **Do not install a liquid sampling valve (LSV) in the valve box if you plan to heat the box above 75 °C. Heating an LSV over 75 °C can cause a leak and subsequent explosion. LSVs should be mounted in the side location to avoid potential explosions.**

1 Gather the following:
   - Replacement valve (See "Consumables and Parts for Valves" on page 194.)
   - T-10 Torx screwdriver
   - 1/4-inch wrench
   - Needle-nosed pliers
   - Vacuum

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING **The oven, inlet, detector, and valve box may be very hot.**

Sample and/or harmful gases may be present. Refer to your company's standard operating procedures for purging the chemicals from the sample line.

3 Set all valves to **Off**.

4 Leave on the GC and valve actuator air.

5 Turn off the carrier gas and sample line flows and relieve any back pressure to the valve.

WARNING

The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

1. **Ventilate your work area**
2. **Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator**
3. **Dispose of insulation in a sealed plastic bag**
4. **Vacuum any residual particles and discard**
5. **Wash your hands with mild soap and cold water after handling RCFs.**

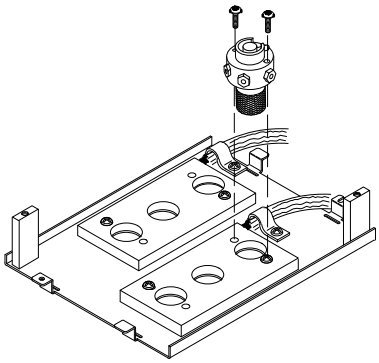
6 Remove the upper valve box. (See "To Remove the Upper Valve Box" on page 202.) Vacuum any RCF insulation particulates from the valve box area.

7 Note the tubing connections to the existing valve and label if desired.

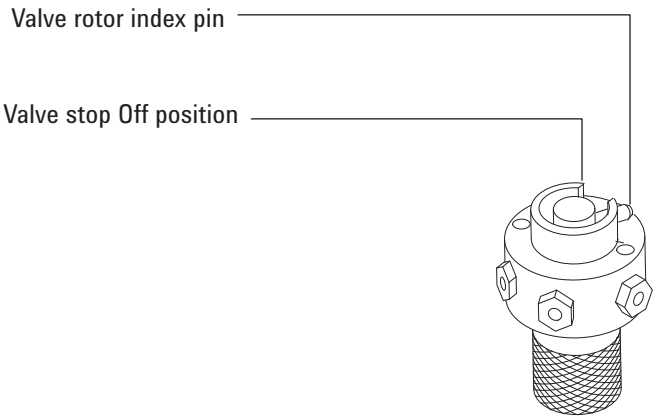
8 Disconnect the existing valve fittings.

9 Remove the two T-10 Torx screws attaching the valve to the valve box, then remove the valve from the valve box.

10 Place the new valve in the valve box. The gap in the index ring on top of a 6-port valve points toward the back of the GC if installed correctly. This is the **On** position. Install and tighten the two screws with a screwdriver.

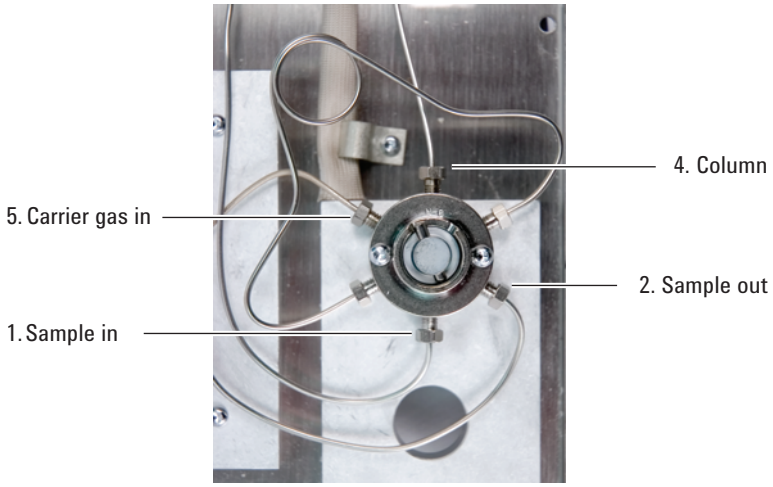


11 Use needle-nosed pliers to move the valve rotor index pin of the valve counterclockwise until the pin touches the valve stop **Off** position.



12 Plumb the new valve using the existing fittings.

WARNING **Hazardous sample gases may be present.**



13 Turn on the carrier and sample gases, then check for leaks at the valve fittings.

- Using the needle-nosed pliers to toggle the valve, check both the **On** and **Off** positions.
- When leak free, set the valve to **Off** (see step 11).

14 Install the upper valve box assembly. (See "To Install the Upper Valve Box" on page 204.)

15 Restore the analytical method.

To Remove the Upper Valve Box

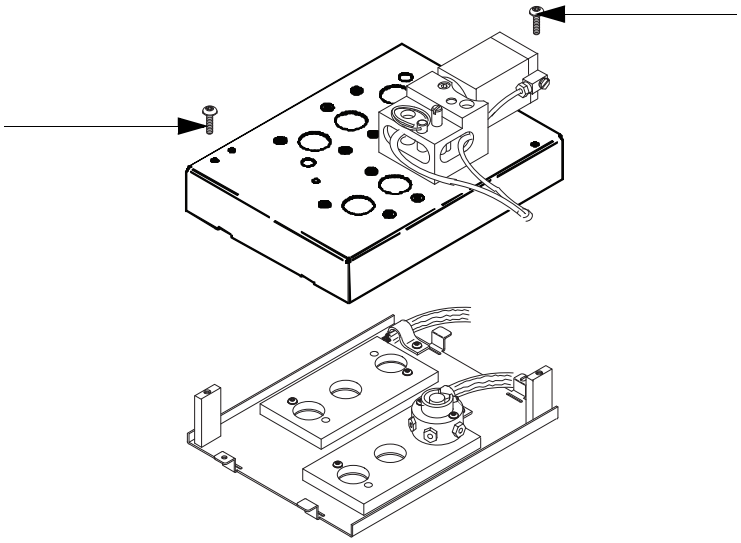
1 Gather a T-20 Torx screwdriver.

2 Set the valve box to a safe handling temperature (25 °C), or load the GC maintenance method.

WARNING **The oven, inlet, detector, and valve box may be very hot. If they are hot, wear heat-resistant gloves to protect your hands.**

3 Lift and remove the detector cover.

4 Remove the mounting screws from the upper valve box.



5 Lift up and set aside.

WARNING

The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

1. **Ventilate your work area**
2. **Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator**
3. **Dispose of insulation in a sealed plastic bag**
4. **Vacuum any residual particles and discard**
5. **Wash your hands with mild soap and cold water after handling RCFs.**

To Install the Upper Valve Box

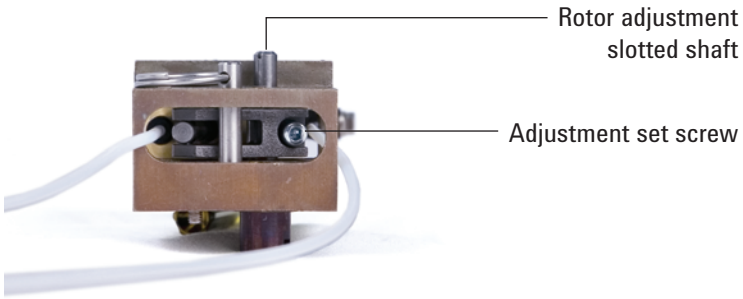
1 Gather the following:

- T-20 Torx screwdriver
- 3-mm hex key wrench
- Flathead screwdriver

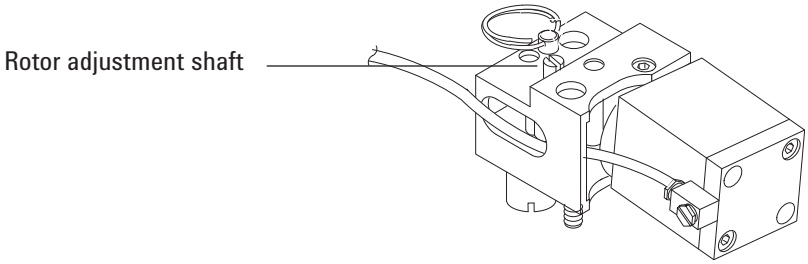
2 Verify that all valve rotors are in the full counterclockwise position (valve **Off**).

3 For each actuator that mates with a newly installed valve:

a Loosen the adjustment set screw.



b Locate the rotor adjustment shaft on top of the actuator. Use a screwdriver to rotate the valve rotor counterclockwise until it stops.



4 Locate the two half-moon cutouts at the bottom back of the upper valve box. Place the upper valve box on top of the lower valve assembly, routing the heater/sensor wires through the cutouts. Secure with two T-20 mounting screws.

5 Push each coupling/shaft assembly downward with a flathead screwdriver until the slot on the coupling engages the rotor index pin.

If the coupling and valve do not engage, check that both are fully counterclockwise and try again. If necessary, turn the shaft slightly to engage the coupling.

6 For each newly installed valve:

   a Using a flathead screwdriver, turn the rotor adjustment shaft counterclockwise until it stops, then back it off a small amount (< 1 mm) to set one end of the rotor's motion.

   b Tighten the adjustment set screw.

7 Install the detector cover.

8 Restore normal operating condition.

12 Maintaining a Valve

A
Swagelok Connections

The gas supply tubing is attached with Swagelok fittings. If you are not familiar with Swagelok connections, review the following procedures.

Making Swagelok Connections

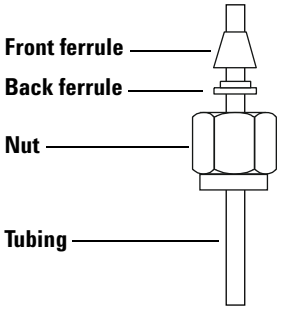
Objective

To make a tubing connection that does not leak and that can be taken apart without damaging the fitting

Materials needed:

- 1/8-inch (or 1/4-inch, if used) preconditioned copper tubing
- 1/8-inch (or 1/4-inch, if used) Swagelok nuts
- Front and back ferrules
- Two 7/16-inch (for 1/8-inch nuts) or 9/16-inch (for 1/4-inch nuts) wrenches

1 Place a Swagelok nut, back ferrule, and front ferrule to the tubing as shown in Figure 7.



IMPORTANT!
The narrow end of the back ferrule fits into the rear of the front ferrule.

Figure 7 Swagelok nuts and ferrules

2 Clamp a stainless steel plug or similar fitting in a bench vise.

CAUTION Use a separate stainless steel fitting in a vise for initial tightening of the nut. Do not use an inlet or detector fitting. Strong forces are required to properly set the ferrules, and damage to an inlet or detector fitting is very costly to repair.

3 Push the tubing into the stainless steel plug (Figure 8).

4 Make sure that the front ferrule is touching the plug. Slide the Swagelok nut over the ferrule and thread it onto the plug.

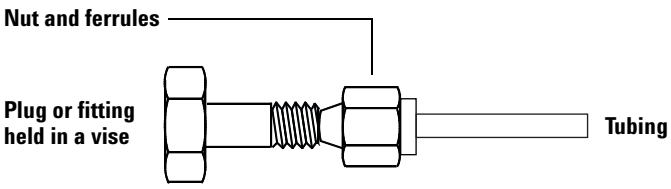


Figure 8 Assembling the fitting

5 Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm (Figure 9).

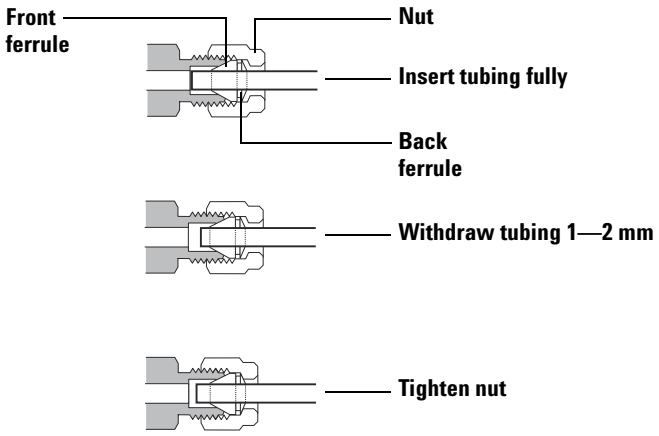


Figure 9 Insert the tubing

6 Finger-tighten the nut.

7 Mark the nut with a pencil line (Figure 10).

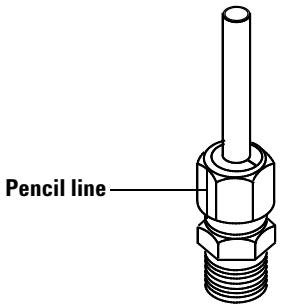


Figure 10 Marking the fitting

8 **For 1/8-inch Swagelok fittings**, use a pair of 7/16-inch wrenches to tighten the fitting 3/4 of a turn (Figure 11). **For 1/4-inch fittings,** use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn (Figure 11).

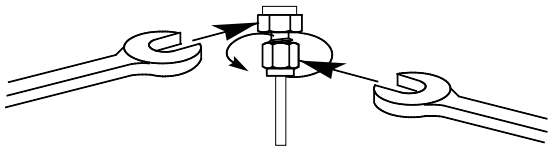


Figure 11 Final tightening

9 Remove the plug from the fitting. To connect the tubing, with nut and ferrules, to another fitting, finger-tighten the nut, then use a wrench to tighten it 3/4 (1/8-inch fittings) or 1-1/4 (1/4-inch fittings) of a turn.

10 Both correctly- and incorrectly-swaged connections are shown in Figure 12. Note that the end of the tubing in a correctly-swaged fitting is not crushed and does not interfere with the action of the ferrules.

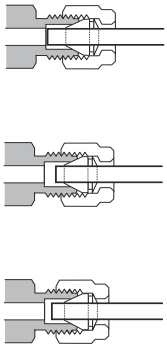


Figure 12 Completed fitting

Using a Swagelok Tee

To supply gas from a single source to more than one input, use a Swagelok Tee.

NOTE Do not combine valve actuator air with flame ionization air. The valve action will cause major upsets in the detector signal.

Materials needed:

- 1/8-inch preconditioned copper tubing
- Tubing cutter
- 1/8-inch Swagelok nuts and front and back ferrules
- 1/8-inch Swagelok Tee
- Two 7/16-inch wrenches
- 1/8-inch Swagelok cap (optional)

1 Cut the tubing where you want to install the Tee. Connect the tubing and Tee with a Swagelok fitting. See Figure 13.

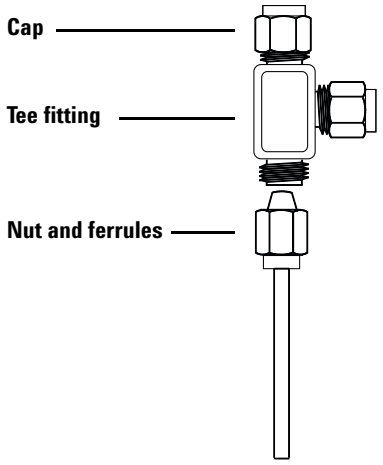


Figure 13 Swagelok tee

2 Measure the distance from the Tee to the GC inlets. Attach copper tubing to the open Tee ends with Swagelok fittings.